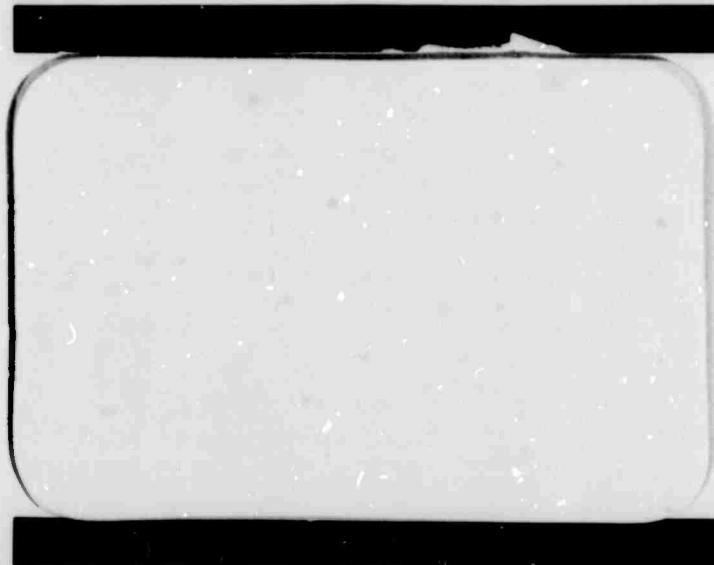


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CONVAIR ASTRONAUTICS

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REDUCTION OF MASS SPECTROMETRIC DATA  
FROM THE  
AEDC (FRT) ROCKET PLUME EXPERIMENTS

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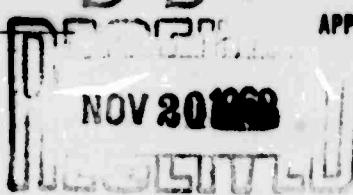


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ABSTRACT

Gas sampling and mass spectrometric analysis are to be used to determine the composition of  $\text{H}_2/\text{O}_2$  and  $\text{H}_2/\text{O}_2$  rocket plumes at various locations downstream of the nozzle exit. The exhaust gases will be analyzed for the constituents  $\text{H}_2$ , He,  $\text{H}_2\text{O}$ ,  $\text{N}_2$ ,  $\text{CO}$ ,  $\text{O}_2$ , Ar, and  $\text{CO}_2$ . The mass spectrometer output is to be digitized and reduced by computational methods presented in this report. From the mass spectrometer output voltages one may determine the sample composition in terms of mole fractions, the mass fraction of entrained air, and the mixture ratio of the rocket. Computer codes for the IBM 650, together with block-diagrams and sample calculations, have been included as an appendix.

**I. Introduction:**

General Dynamics will conduct a study of the high-altitude behavior of rocket plumes in the Propulsion Wind Tunnel at Arnold Engineering and Development Center, Tullahoma, Tenn. One of the parts of the study is the sampling and analysis of the exhaust gases at various locations. A Consolidated Electrodynamics Corporation mass spectrometer, Model 21-620A, will be used to continuously monitor the exhaust gases. The output from this instrument will be digitized on punched tape and reduced by computer within a short period after the test has been conducted. This report represents methods of data reduction and block-diagrams of the necessary computer programs.

We presume the reader is familiar with the operation of a mass spectrometer, and we will not present the operating principles here. The particular instrument which will be used at AEDC has been modified so that mass-to-charge ratios from 2 to 19 appear on a single repeller setting. A low-pressure inlet system admits a heated gas sample to the system at about 0.05 psia collection pressure. Two peak selectors (Model 133250) have been ganged together to permit automatic stepping between a maximum of 12 different mass/charge ratios. Because the accelerating voltage takes some time to decay to a new value when the position of the selector switch is changed, it has been found necessary to interpose one or two "extra" settings between mass numbers which are far apart in terms of required voltage settings.

Essentially five different types of analyses are to be performed: background check, calibration, oxygen feed, RP-1/ $O_2$  plume, and  $H_2/O_2$

plume. The RP-1/O<sub>2</sub> plume will be analyzed for H<sub>2</sub>, He, H<sub>2</sub>O, N<sub>2</sub>, CO, O<sub>2</sub>, Ar, and CO<sub>2</sub> with the peak selector channels assigned as shown in Procedure A, Table I. Background checks (run at the beginning of each day, and before every 30-minute run) and oxygen feed analyses will also be conducted under this procedure when an RP-1/O<sub>2</sub> firing is being conducted. All calibrations will also be performed under this procedure. The H<sub>2</sub>/O<sub>2</sub> plume will be analyzed for H<sub>2</sub>, He, H<sub>2</sub>O, N<sub>2</sub>, O<sub>2</sub>, and Ar according to Procedure B, since about 20 seconds per sample can be saved in this fashion. Backgrounds and O<sub>2</sub> feed analyses will be run according to Procedure B if H<sub>2</sub>/O<sub>2</sub> firings are scheduled. Propellant oxygen will be analyzed for He, O<sub>2</sub>, N<sub>2</sub>, and Ar.

The data to be taken from each sample in order to perform a complete analysis, consist of the following items:

- 1) A tag number, Q, which identifies the sample being taken. Values of Q required range from zero to nine (0 - 9) and are shown in Table II.
- 2) The peak being analyzed. There are 12 peaks in all, their positions are preset by potentiometers on the peak selector chassis. Probably the best way to monitor the peak selector output is to pick up the position of the stepping switch. This might conveniently be taken off at the pilot lamp which indicates the energized channel to the operator.
- 3) The base line for each peak, or zero (Zi)
- 4) The maximum output at each peak (Bi)
- 5) An attenuation factor (Ai) for each peak; this is the factor by

which the output has been divided in order to keep it in the 0 - 10 mv. range. (This is done by means of series resistances). These data must be operated upon in order to express the composition of the sampled gases in mole fractions. This data reduction is to be done by means of a digital computer which will use the digitized mass spectrometer output as input.

Two machine programs will be required. One program calculates the sensitivity of the instrument to the different gases relative to the mass 28 peak of  $N_2$ , which is arbitrarily set at 100. In the following discussion, we shall identify the sensitivity of the instrument to the  $j^{\text{th}}$  gas (where the identifying subscript  $j$  is assigned as shown in Table I) at the  $i^{\text{th}}$  mass number or peak selector channel as  $S_{ij}$ . The second program uses the  $S_{ij}$ 's and the output from the mass spectrometer caused by the sampled gases to calculate the mole fractions  $x_j$  of the constituents of the sample, the weight fraction  $R$  of entrained air determined from all the constituents, the weight fraction of air  $A$  determined from an argon-helium balance, the mixture ratio  $M_c$  of the rocket as determined from the sampled gases, and the carbon/hydrogen ratio  $D$  of the sample. This report includes block-diagrams, SOAP codes for the IBM 650, and complete hand-checks of the programs using representative inputs.

TABLE I: PEAK SELECTION PROCEDURES

Channel	Procedure A			Procedure B		
	Approx. Volts	Gas	Mass Peak	Approx. Volts	Gas	Mass Peak
1	160	—	—	160	—	0
2	156	H <sub>2</sub>	2	1	H <sub>2</sub>	1
3	80	—	—	80	—	—
4	76	He	4	2	He	2
5	26	—	—	20	—	—
6	24.5	N <sub>2</sub> , CO	14	4.5	H <sub>2</sub> O	3
7	19	H <sub>2</sub> O	18	3	13	—
8	13	—	—	12.5	N <sub>2</sub>	4
9	12.5	N <sub>2</sub> , CO, CO <sub>2</sub>	28	4.5, 8	11.5	26
10	11.5	O <sub>2</sub>	32	6	10	6
11	10	Ar	40	7	160	—
12	9	CO <sub>2</sub>	44	8	160	—

TABLE II: ASSIGNMENT OF Q-NUMBERS

q	<u>Calibration</u>	<u>Analysis</u>	
		<u>Procedure A</u>	<u>Procedure B</u>
0	Background	Background	Background
1	Air	O <sub>2</sub> feed	—
2	N <sub>2</sub>	Plume	—
3	O <sub>2</sub>	—	O <sub>2</sub> feed
4	Ar	—	Plume
5	CO	—	—
6	CO <sub>2</sub>	—	—
7	H <sub>2</sub>	—	—
8	He	—	—
9	H <sub>2</sub> O	—	—

**II. Analysis:**

The instrument will be calibrated once each day, or oftener if it appears necessary, by admitting a sample of pure gas to the auxiliary inlet at exactly atmospheric pressure, expanding it to the expansion volume, and introducing it into the mass spectrometer in "batch" fashion. The mass spectrometer is sensitive to the partial pressure of a particular gas at its inlet. Since we are analyzing all gases, we do not need the absolute sensitivity of each gas in volts output per pressure unit, but only the relative sensitivity. We shall arbitrarily designate the sensitivity  $S_{ij}$  of  $N_2$  at mass 28 as 100, and refer others to it. This is allowable if the calibrating gases are all introduced at the same pressure into the inlet system.

It is conceivable that we may introduce some air into the instrument together with the calibrating gas. We can correct for an air impurity if the first calibrating gas which we run each day is air. The mole fraction of air is then easily determined by monitoring either the mass 28 or mass 32 peak choosing whichever does not occur in the mass spectrum of the pure gas. If the pure gas peak whose sensitivity we are measuring does not occur in air (i.e., does not happen to be 14, 28, 32, or 40), then the sensitivity of the pure gas is determined by dividing its apparent sensitivity (measured with the air contamination present) by its mole fraction, which is one less the mole fraction of air if no other contaminants are assumed to be present. If the particular peak of interest is one which also occurs in air, the air contaminant must be

subtracted from the peak height in order to determine the true value.

As an instructive example, consider the calibration of the instrument for sensitivity to  $\text{CO}_2$  (gas number,  $j = 8$ ) at the mass 28 ( $i = 9$ ) and 44 ( $i = 12$ ) peaks. The amount of air is determined by monitoring the peak at mass 32 ( $i = 10$ ); the sensitivity of the instrument to oxygen at this mass number has been previously determined. The instrument measures the output voltage or peak height ( $H_i$ ), the zero line ( $Z_i$ ), and the attenuation factor ( $A_i$ ) at all twelve peaks; we choose to operate only on peaks number  $i = 9, 10, 12$ . The corrected peak height  $C_i$  is determined by subtracting the zero reading from the measured value and multiplying by the attenuation factor, thus:

$$C_i = A_i (H_i - Z_i)$$

The background reading,  $B_i$ , which was previously determined, is subtracted from  $C_i$  to give the true peak height  $T_i$ :

$$T_i = C_i - B_i$$

The mole fraction of oxygen in the sample may be determined by dividing the true output at peak 10 by the output of pure oxygen at the same peak (and at the same sampling pressure), or since we use nitrogen as our reference,

$$x_6 = T_{10} S_{9,4} / S_{10,6} P_9$$

In the above expression  $x_6$  is the mole fraction of  $\text{O}_2$  (gas number,  $j = 6$ ),  $S_{9,4}$  ( $\approx 100$ ) is the instrument sensitivity to nitrogen (gas number,  $j = 4$ ) at the mass 28 peak ( $i = 9$ ),  $S_{10,6}$  is the sensitivity to  $\text{O}_2$  at mass 32 ( $i = 10, j = 6$ ) and  $P_9$  is the instrument's response to a pure nitrogen sample at mass 28 at the same pressure as the  $\text{CO}_2$  sample. We may then

determine the instrument's response to  $\text{CO}_2$  at mass 44 ( $S_{12,8}$ ) by the relation

$$S_{12,8} = T_{12} S_{9,4} / P_9 (1 - x_6 / 0.2095)$$

where 0.2095 is the mole fraction of oxygen in air. The response observed at mass 28 is due to both  $\text{N}_2$  and  $\text{CO}_2$ . The response due to  $\text{N}_2$  is

$$\frac{0.7808}{0.2095} x_6 P_9$$

where 0.7808 is the mole fraction of  $\text{N}_2$  in air. Then

$$S_{9,8} = \frac{S_{9,4}}{P_9} \frac{T_9 - \frac{0.7808 x_6 P_9}{0.2095}}{1 - x_6 / 0.2095}$$

The block diagram of the calibration program was constructed from these and similar considerations. A bit of study will show how the corrections for air were performed in other cases.

The output of the calibration runs will be used in the analysis of the oxygen feed and plume samples, together with the output data (H, A, and Z) from these runs. For every component except  $\text{N}_2$  and  $\text{CO}$ , the response factor  $F_j$  is determined by a relation

$$F_j = T_i / S_{i,j}$$

$\text{N}_2$  and  $\text{CO}$  both have major peaks at mass 14 and mass 28. The situation at mass 28 is further complicated because  $\text{CO}_2$  has a peak there also. The procedure adopted is to subtract out the  $\text{CO}_2$  contribution to the mass 28 output, as follows:

$$T'_9 = T_9 - F_8 S_{9,8} / S_{12,8}$$

Then we may solve the following simultaneous equations for  $F_4$  and  $F_5$  (response factors for  $N_2$  and CO):

$$S_{9,5} F_5 + S_{9,4} F_4 = T_9$$

$$S_{6,5} F_5 + S_{6,4} F_4 = T_6$$

Since there is no CO or  $CO_2$  in the  $H_2/O_2$  samples, we can calculate all response factors in the same manner. Once we have all the  $F_j$ 's, we may calculate the mole fractions of the different components:

$$x_j = F_j / \sum_{j=1}^8 F_j$$

The oxygen feed samples and the plume samples using  $H_2/O_2$  propellant do not contain either CO or  $CO_2$ , so that we may revise our procedures slightly in order to conserve tunnel time. This is why the subscripts in the analysis program block-diagram under tag numbers 3 and 4 ( $O_2$  feed and  $H_2/O_2$  plume sample, respectively) do not always match up.

In the plume samples, there are a number of quantities of interest which may be derived from the composition in terms of mole fractions. One of these is the ratio of hydrogen atoms to carbon atoms in the sampled gas. In RP-1 this ratio is about 2.0; its deviation from this figure in the sampled gases is a measure of the sampling error, since neither H nor C is added to the gas by the oxygen feed or the entrained air. We can compute this ratio (D) simply by summing the hydrogen-containing compounds multiplied by the subscript of hydrogen in each compound, and dividing by the similar sum of the carbon-containing compounds, e.g.,

$$D = (2 x_{H_2O} + 2 x_{H_2}) / (x_{CO} + x_{CO_2}) = (2x_3 + 2x_1) / (x_5 + x_8)$$

This computation is of course not performed when  $H_2$  is the fuel.

The weight fraction of entrained air may be computed in two ways: The first requires an accurate analysis of the sampled gas, in that the true proportions of all components must be known. Since nitrogen is nearly inert, its relative proportion in the sample is unchanged by any reactions in the gas or in the sampling process (if a true sample is taken). We may thus compute a "mole fraction" of air (not a true mole fraction, since in general some of the oxygen has reacted) by the relation

$$X_A = X_{N_2} / 0.7808 = X_q / 0.7808$$

The "molecular weight" of air is 28.962; a molecular weight of the exhaust gases,  $N$ , may be calculated by the relation

$$N = \sum_{j=1}^m x_j M_j$$

where  $M$  is 6 in a  $H_2/O_2$  firing and 8 in an RP-1/ $O_2$  firing. Then the weight fraction of air computed in this manner is

$$A = 28.962 X_A / 0.7808 N$$

A second method of computing the weight fraction of air does not require an accurate analysis of the sampled gases, but does require an analysis of the oxygen feed. This method utilizes an inert gas tracer (He) added to the  $O_2$  feed and another inert tracer (Ar) which is naturally present in air. The weight fraction of He in the  $O_2$  sample is

$$w_{2,0} = 4.005 X_{2,0} / N_0$$

This quantity is calculated from the oxygen analysis at the beginning of each 50-minute run. There will also probably be some argon present in

the oxygen; the weight fraction of argon is, similarly,

$$w_{7,0} = 39.944 \times w_{4,0} / N_0$$

(These quantities may be corrected for an air leak). The weight ratio of helium to argon in the plume sample may easily be determined from the mole ratios:

$$(w_2/w_7)_p = 4.003 \times w_2 / 39.944 \times w_7$$

The weight fraction of argon in air is 0.01288. From these four quantities,  $w_{2,0}$ ,  $w_{7,0}$ ,  $(w_2/w_7)_p$ , and  $w_7$ , air = .01288, we may compute the fraction of air independently from any effects of reaction.

Let the mixture ratio (determined by measuring the propellant flow rates) of the rocket be  $M$ . Then, on the basis of one lb. of fuel,  $M$  lbs. of oxygen enters the chamber, and  $M + 1$  lb. of exhaust gases are formed. The weight fraction of helium in the exhaust is

$$w_{2,E} = w_{2,0} M / (M+1)$$

and likewise for argon. Let  $B$  lbs. of air be mixed with the  $M+1$  lbs. of exhaust to form  $M+1+B$  lbs. of plume. The weight fraction of He in the plume is:

$$w_2 = w_{2,0} M / (M + 1 + B)$$

The weight fraction of argon is:

$$w_7 = \frac{w_{7,0} M + 0.01288 B}{M + 1 + B}$$

and the ratio is

$$w_7/w_2 = w_{7,0}/w_{2,0} + (B/M) 0.01288/w_{2,0}$$

$$\text{whence } (B/M) = \frac{w_7/w_2 - w_{7,0}/w_{2,0}}{0.01288/w_{2,0}}$$

The air/oxygen ratio  $B/M$  may be used to calculate the weight fraction of entrained air,  $R$ , as follows:

$$R = M (B/M) / [M + 1 + M (B/M)]$$

$$\text{whence } R = \frac{M (w_7/w_2 - w_{7,0}/w_{2,0}) w_{2,0}/0.01288}{1 + M + (w_7/w_2 - w_{7,0}/w_{2,0}) w_{2,0}/0.01288}$$

The mixture ratio may also be determined from a knowledge of the total composition. Let us call this quantity  $M_c$ , to distinguish it from the measured mixture ratio  $M$ . The weight of fuel in one mole of sampled plume gas is given by

$$w_F = 2.016 (x_1 + x_3) + 12.010 (x_5 + x_8)$$

(The second term is not present if an  $H_2/O_2$  run is being analyzed). The weight of oxygen is

$$w_{ox} = 32.000 (\frac{1}{2} x_3 + \frac{1}{2} x_5 + x_6 + x_8)$$

Part of this comes from entrained air, so that the amount due only to the propellant feed is

$$w_{ox,0} = 32.000 (\frac{1}{2} x_3 + \frac{1}{2} x_5 + x_6 + x_8 - \frac{0.2095}{0.7808} x_4)$$

The mixture ratio is then

$$\frac{M_c}{w_F} = \frac{32.000 (\frac{1}{2} x_3 + \frac{1}{2} x_5 + x_6 + x_8 - \frac{0.2095}{0.7808} x_4)}{2.016 (x_1 + x_3) + 12.010 (x_5 + x_8)}$$

An alternative expression may be developed by using the relationship

$x_1 + x_3 = x_5 + x_8$  if the H/C ratio of the fuel is 2. Then

$$x_c = \frac{32.000 (\frac{1}{2}x_3 + \frac{1}{2}x_5 + x_6 + x_8 - 0.2683 x_4)}{14.026 (x_5 + x_8)}$$

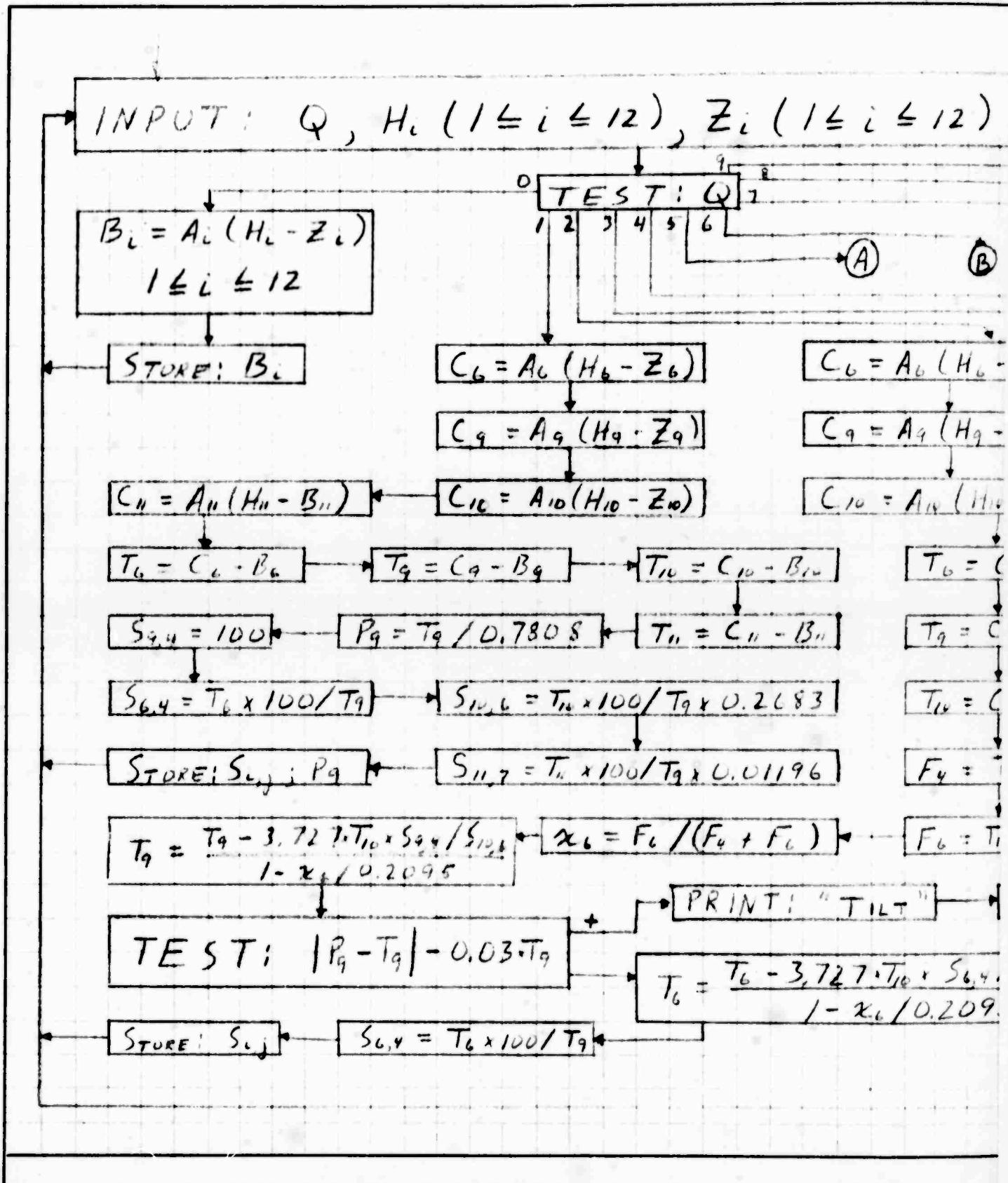
This last expression puts less reliance on the accuracy of the analysis of the condensable component  $H_2O$ ; it can only be used for the RP-1/ $O_2$  runs.

**III. Conclusions:**

On the basis of the considerations indicated in the preceding section, we have developed computer programs suitable for the reduction of digitized mass spectrometer output data. In the appendix, block-diagrams, SOAP codes suitable for the IBM 650, sample inputs, and hand-computed results are presented. These results may be used in incorporating these data reduction procedures into the AEDC system. The input required for calibrations are the individual peak heights, base lines, and attenuation factors, as well as tag numbers (0 - 9) which identify the different gases. The output of the calibration data reduction program consists of the relative sensitivities of the different constituents. The analysis of a gas sample requires the same type of input as the calibration runs, and also the sensitivities and a measured propellant mixture ratio. The output of this program is the mole fractions of the different gases in the sample, the H/C ratio of the fuel (if it is RP-1), the weight fraction of entrained air (computed in two ways), and the mixture ratio of the propellant as computed from the sample composition. This information can be used in a number of subsequent calculations; some of these will be discussed in another report.

TABLE III: NOMENCLATURE

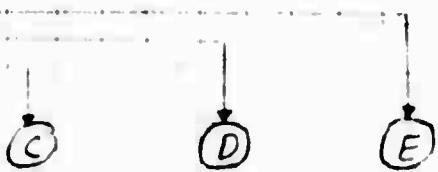
A	Mass fraction of entrained air (from total composition)
$A_i$	Attenuation factor at $i^{\text{th}}$ mass peak
$B_i$	Background peak height at $i^{\text{th}}$ mass peak
$C_i$	Corrected peak height at $i^{\text{th}}$ mass peak
D	Hydrogen/carbon ratio of fuel
$F_j$	Response factor due to the $j^{\text{th}}$ component
$H_i$	Measured peak height at $i^{\text{th}}$ mass peak
M	Measured mixture ratio of propellant
$M_e$	Calculated mixture ratio
N	Molecular weight of sampled gases
$P_9$	Response of instrument to $N_2$ at mass 28
Q	Tug number, identifying sample
R	Mass fraction of entrained air (from Ar/He balance)
$S_{ij}$	Sensitivity at $i^{\text{th}}$ mass peak of $j^{\text{th}}$ component, relative to $S_{28, N_2} = 100$
$T_i$	True peak height at $i^{\text{th}}$ mass peak
$w_j$	Weight fraction of $j^{\text{th}}$ component in sample
$x_j$	Mole fraction of $j^{\text{th}}$ component in sample
$z_i$	Zero or base line at $i^{\text{th}}$ mass peak



A

END

$A_c (1 \leq c \leq 12)$



(NEXT PAGE)

$$\begin{aligned}
 & C_9 = A_9 (H_9 - Z_9) \\
 & C_{10} = A_{10} (H_{10} - Z_{10}) \\
 & T_9 = C_9 / B_9 \\
 & T_{10} = C_{10} / B_{10} \\
 & F_4 = T_9 / 100 \\
 & F_6 = T_{10} / S_{10.6}
 \end{aligned}$$

$$\begin{aligned}
 & C_9 = A_9 (H_9 - Z_9) \rightarrow C_{11} = A_{11} (H_{11} - Z_{11}) \\
 & T_{11} = C_{11} / B_{11} \rightarrow T_9 = C_9 / B_9 \\
 & F_4 = T_9 / 100 \rightarrow F_7 = T_{11} / S_{11.7} \\
 & x_4 = F_4 / (F_4 + F_6 / 0.7808) \\
 & T_{11} = \frac{T_{11} + 0.01196 \cdot T_9 \cdot S_{11.7} / 100}{1 - x_4 / 0.7808} \\
 & S_{11.7} = T_{11} \times 100 / F_7 \rightarrow S_{11.7} / S_{11.6}
 \end{aligned}$$

$$T_{10} = \frac{T_{10} - 0.2683 \cdot T_9 \cdot S_{10.6} / 100}{1 - x_4 / 0.7808}$$

$$S_{10.6} = T_{10} \times 100 / F_4$$

$$STROKE: S_{c_{11}}$$

B

## CALIBRATION

(A)

$$C_6 = A_6 (H_6 - Z_6)$$

$$C_9 = A_9 (H_9 - Z_9)$$

$$C_{10} = A_{10} (H_{10} - Z_{10})$$

$$T_6 = C_6 - B_6$$

$$T_9 = C_9 - B_9$$

$$T_{10} = C_{10} - B_{10}$$

$$x_6 = T_{10} \times 100 / P_9 \times S_{10,6}$$

$$T_6 = \frac{T_6 - 3.727 \cdot T_{10} + S_{6,4} / S_{10,6}}{1 - x_6 / 0.2095}$$

$$T_9 = \frac{T_9 - 3.727 \cdot T_6 \times 100 / S_{10,6}}{1 - x_6 / 0.2095}$$

$$S_{6,5} = T_6 \times 100 / P_9$$

$$S_{9,5} = T_9 \times 100 / P_9$$

$$S_{TURF} : S_{6,5}$$

(B)

$$C_9 = A_9 (H_9 - Z_9) \rightarrow C_{10} = A_{10} (H_{10} - Z_{10})$$

$$T_9 = C_9 - B_9 \rightarrow C_{10} = A_{10} (H_{10} - Z_{10})$$

$$T_{10} = C_{10} - B_{10} \rightarrow T_{12} = C_{12} - B_{12}$$

$$x_6 = T_{10} \times 100 / P_9 \times S_{10,6}$$

$$T_9 = \frac{T_9 - 3.727 \cdot T_{10} \times 100 / S_{10,6}}{1 - x_6 / 0.2095}$$

$$T_{12} = T_{12} / (1 - x_6 / 0.2095)$$

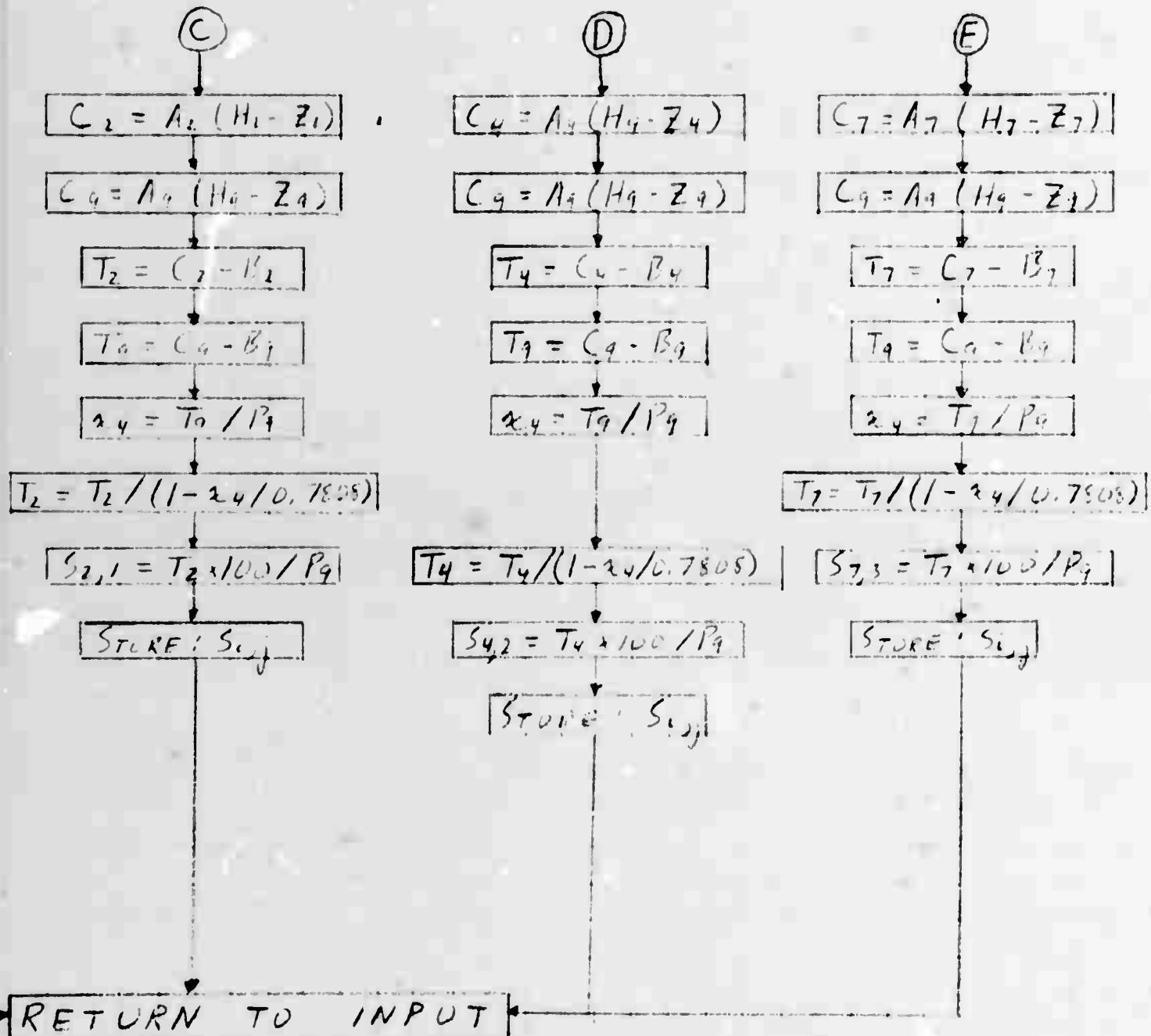
$$S_{9,5} = T_9 \times 100 / P_9$$

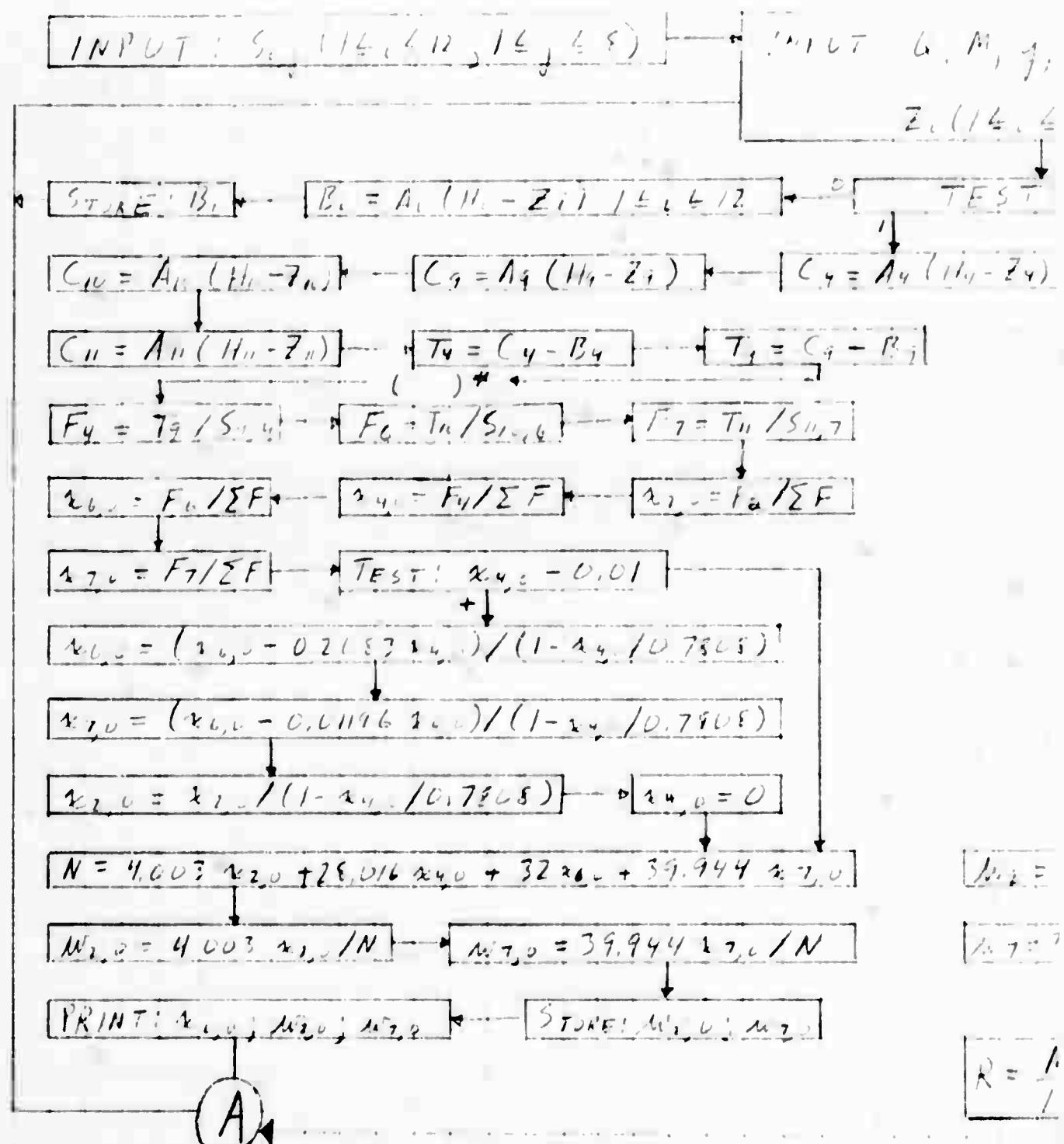
$$S_{12,5} = T_{12} \times 100 / P_9$$

$$S_{TURF} : S_{12,5}$$

A

(CONT.)





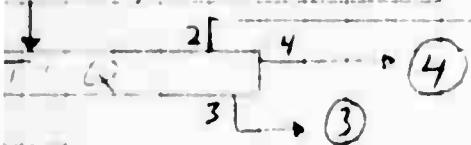
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$$y, r, H, (1 \leq i \leq 12)$$

$$\leq 12), A_i (1 \leq i \leq 12)$$



(3)

$$C_4 = A_4 (H_4 - Z_4) \rightarrow C_5 = A_5 (H_5 - Z_5)$$

$$C_6 = A_6 (H_6 - Z_6) \rightarrow C_7 = A_7 (H_7 - Z_7)$$

$$T_4 = C_4 - B_4 \rightarrow T_5 = C_5 - B_5 \rightarrow T_6 = C_6 - B_6$$

$$F_4 = T_4 / S_{1,4} \rightarrow F_5 = T_5 / S_{1,5} \rightarrow T_{10} = C_{10} - B_{10}$$

$$F_6 = T_6 / S_{1,6} \rightarrow F_7 = T_{10} / S_{1,7} \rightarrow x_{2,0} = F_2 / \sum F$$

$$x_{7,0} = F_7 / \sum F \rightarrow x_{6,0} = F_6 / \sum F \rightarrow x_{4,0} = F_4 / \sum F$$

$$T_{FS} = x_{4,0} - 0.01$$

$$x_{4,0} = (x_{4,0} - 0.2683 x_{4,0}) / (1 - x_{4,0} / 0.7808)$$

$$x_{7,0} = (x_{7,0} - 0.11196 x_{4,0}) / (1 - x_{7,0} / 0.7808)$$

$$x_{1,0} = x_{1,0} / (1 - x_{4,0} / 0.7808) \rightarrow x_{4,0} = 0$$

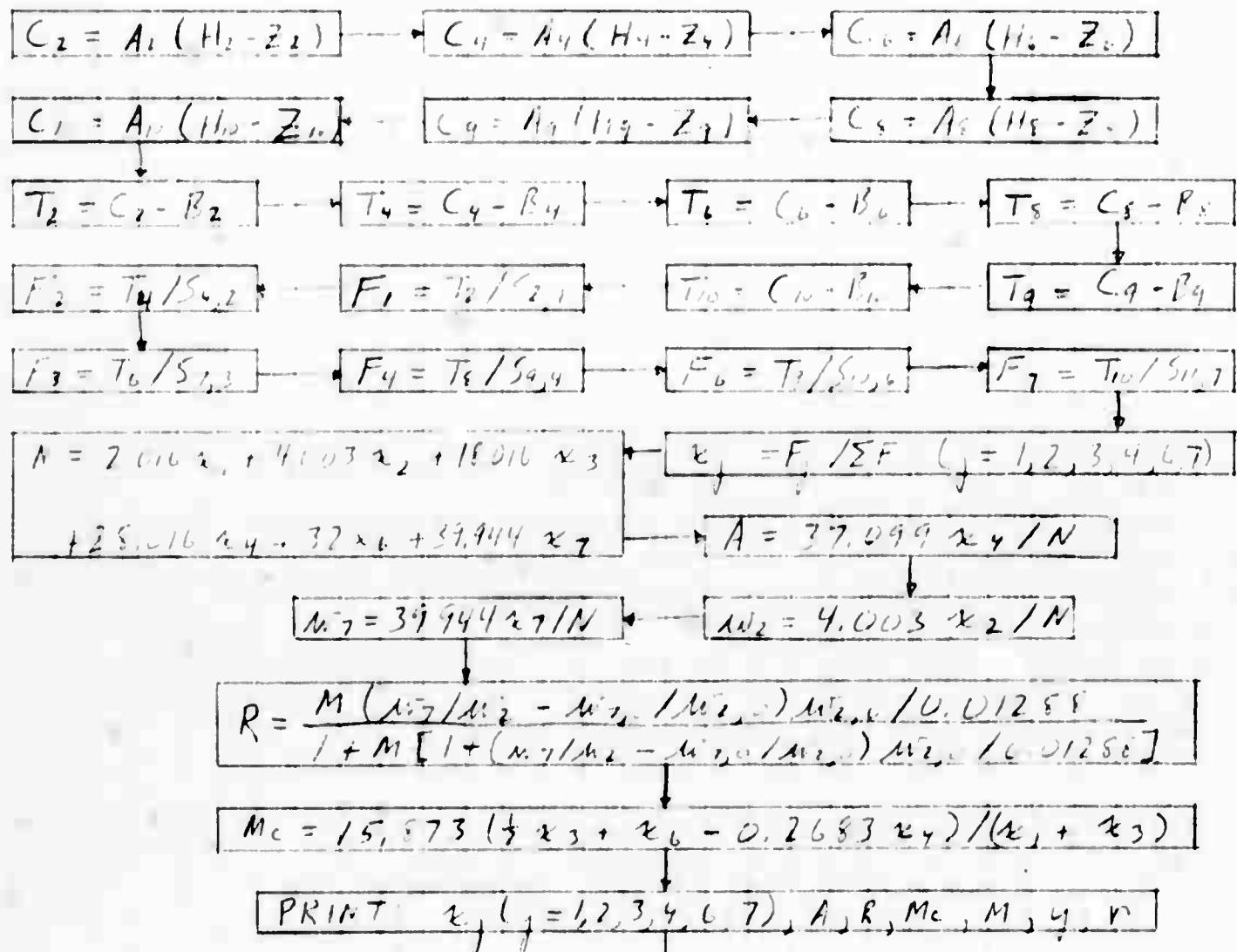
$$N = 4.003 x_{2,0} + 26.616 x_{4,0} + 32 x_{6,0} + 39.944 x_{7,0}$$

$$m_{2,0} = 4.003 x_{2,0} / N \rightarrow m_{2,0} = 39.944 x_{7,0} / N$$

PRINT:  $x_{1,0}$ ;  $m_{2,0}$ ;  $m_{7,0}$  → STORE:  $m_{2,0}$ ,  $x_{7,0}$

A

## TEXT NOT REPRODUCIBLE



GO TO ①

3

## SAMPLE INPUT (ANALYSIS)

i = 1 2 3 4 5 6 7

INIT	$S_{i,j} = 1$	39.36					
2			16.70				
3							86.71
4						7.224	
5						0.2663	
6							
7							
8							

$Q=0$	H	10	15	4	7	10	20.5	36	1
	A	1	1	1	1	1	1	3	
	Z	10	10	4	6	10	10	10	1

$Q=1$	H	4	15	4	29.4	10	20.5	36	1
	A	1	1	1	1	1	1	3	
	Z	4	10	4	6	10	10	10	1

$Q=2$	H	10	48.5	4	18	10	77.5	54.3	1
	A	1	10	1	1	10	10	100	
	Z	10	10	4	6	10	10	10	1

$Q=0$	H	10	20	4	6	10	36	10	6
	A	1	1	1	1	1	3	1	
	Z	10	10	4	6	10	10	10	1

$Q=3$	H	10	20	4	47.3	10	36	10	67.
	A	1	1	1	3	1	3	1	3
	Z	10	10	4	9	10	10	10	10

$Q=4$	H	10	76.1	4	47.3	10	47.6	10	99
	A	1	100	1	3	1	300	1	1
	Z	10	10	4	9	10	10	10	10

A

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9 9 10 11 12

100.0

99.47

76.75

123.1

7.248

114.3

10 54.5 39 16 20

1 3 1 1 1

10 10 10 13 11

10 62.5 46.6 46 20

1 3 300 1 1

10 10 10 13 11

10 50 85 64.6 48.1

1 300 1 3 100

10 10 10 10 10

r 3

y 60

M 1.9

65 15.4 14 2 2

1 1 1 10 10

10 10 13 2 2

67.3 70.2 28 2 2

3 100 1 10 10

10 10 13 2 2

99.4 74 19.4 2 2

1 1 1 10 10

10 10 13 2 2

r 3

y 60

M 3.5

13

## SAMPLE CALCULATION (ANALYSIS)

	Q = 0	1	2	0	3	4
B	i = 1	0		0		
	2	5		10		
	3	0		0		
	4	1		0		
	5	0		0		
	6	10.5		78		
	7	78		0		
	8	0		55		
	9	133.5		.5.4		
	10	29		1		
	11	6		0		
	12	9		0		
C	i = 1					
	2		385		6610	
	3					
	4	23.4	12	114.9	114.9	
	5					
	6		675		11,280	
	7		4430			
	8			171.9	99.4	
	9		167.5	12,000	6020	64
	10		10,980	75	15	6.4
	11		33	163.8		
	12			3810		
T	i = 1					
	2		380		6600	
	3					
	4	22.4	11	114.9	114.9	
	5					
	6		664.5		11,200	
	7		4352			
	8					
	9		26	11866	6015	35.4
	10		10,950	46	14	59.6
	11		27	157.8		5.4
	12			3801		
L	A.		11625			

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	0	1	2	0	3	3 <sup>1</sup>	4
F	$\sum f = 1$		9.654				167.7
	1	1.341	.6597		6.990		6.980
	2						
	3		50.19				129.2
	4	.240	91.06			1.169	0.354
	5		25.33				<del>0.776</del>
	6	142.7	.5993		78.37		0.776
	7		.2193	1.282		.1137	0472
	8			33.25			
$\Sigma F$		144.4	212.0		86.53		305.0
$\Sigma$	$\sum j = 1$		.009286	.04553			.5498
	2		.009286	.003107			.02256
	3			.2367			.4236
	4		.001662	.4295			.000116
	5		<del>.000116</del>	.1195			<del>0.000116</del>
	6		.9882	.002926			.002544
	7		.001518	.006047			.000154
	8			.1568			
N		31.77	26.98				8.952
$W_2$			.001170	.000461			.01009
$W_3$			.001908	.008953			.000687
A				.5905			.004806
R				.5144			
D				2.043			
Mc				1.839			
M				1.9			

\* Corrected for Air leak

⑤

## SAMPLE INPUT (CALIBRATION)

		$L=1$	$2$	$3$	$4$	$5$
$Q=0$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=1$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=2$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=3$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=4$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=5$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=6$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10
$Q=7$	$H$	710	76	4	7	10
	$A$	100	100	1	1	1
	$Z$	110	10	4	6	10
$Q=8$	$H$	10	15	4	39	10
	$A$	1	1	1	100	1
	$Z$	10	10	4	10	10
$Q=9$	$H$	10	15	4	7	10
	$A$	1	1	1	1	1
	$Z$	10	10	4	6	10

A

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v)

6 7 8 9 10 11 12

19	36	10	55	36	16	17
1	3	1	3	1	1	1
10	10	10	10	10	13	11

42	38	10	54.3	40	52.3	22
30	3	1	300	100	3	11
10	10	10	10	10	11	11

51	36	10	66.5	58	17	17
30	3	1	300	1	1	1
10	10	10	10	10	13	11

26	36	10	82	53	18	17
1	3	1	3	300	1	1
10	10	10	10	10	13	11

26	36	10	82	46	78.7	17
1	3	1	3	1	300	1
10	10	10	10	10	10	11

66.7	36	10	64.8	44	16	17
1	3	1	300	1	1	1
10	10	10	10	10	13	11

20	36	10	24.1	48	16	74
1	3	1	100	1	1	300
10	10	10	10	10	13	10

26	36	10	15	4	10	10
1	3	1	1	1	1	1
10	10	10	10	4	10	10

26	36	10	82	46	18	17
1	3	1	3	1	1	1
10	10	10	10	10	13	11

19	59	10	55	36	16	17
1	300	1	3	1	1	1
10	10	10	10	10	13	11

8

CONVAIR  
SAN DIEGO

SAMPLE CALCULATION (CALIBRATION)

$Q=1$

2

3

4

5

$C_2$

$T_2$

$C_4$

$T_4$

$C_6$

960

1270

56.7

$T_6$

951

1221

1223

47.7

44.

$C_7$

$T_7$

$C_9$  13,290

16,950

216

216

16,440

$T_9$  18,160

16,920

16,930

81

81

16,300

16,300

$C_{10}$  3,000

48

12,900

34

$T_{10}$  2,974

22

12,870

12,940

8

$C_{11}$  213.9

210.9

20,610

$T_{11}$  210.9

20,607

20,750

$C_{12}$

$T_{12}$

$P_9$  16,860

$F_4$

168.2

0.81

0.81

$F_6$

0.2612

152.8

$F_7$

153.8

$x_4$

.00527

.00527

.000627

$x_6$

.00155

$S_{2,1}$

$S_{4,2}$

$S_{6,4}$

7.224

0.2

$S_{6,5}$

$S_{7,3}$

$S_{9,4}$

$S_{9,5}$

$S_{9,8}$

$S_{10,6}$

84.23

$S_{11,7}$

134.0

$S_{12,8}$

76.75

123.1

A

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6	7	8	9	i	B <sub>c</sub>
	6,600 6,595	6,636		1 2 3 4 5 6 7 8 9 10 11 12	0 5 0 1 0 9 79 0 135 10 11 3 12 6
4.89		2,800 2,799	2,816		
b,310	1,410 1,275 38 12	216 1,222 81	216 81		
	19,200 19,190	19,270			
	.00092	.00480	.00480 39.36	0	
			16.70		
2663				86.71	
9.47	7.248				
	114.3				
					B

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SOAP CODE ANALYSIS

IBM 650 INPUT

Q	0	1	2	PART A	CELL LOCATION
Q	0	3	4	PART B	
H	I	I	I	12	0 1 TO 0012
Z	I	I	I	12	0 13 TO 0024
A	I	I	I	12	0 25 TO 0036
SIJ	2	I	9	1 J 8 0	57 TO 0064
M	1A	OR	M	1B	0 48
Y	1A	OR	Y	1B	0 49
LOWER CASE Y					
R	1A	OR	R	1B	0 50
LOWER CASE R					
Q	0	1	2	PART A	CELL LOCATION
Q	0	3	4	PART B	
X	I	I	I	8	0 77 TO 0084
PUNCH X					
XIJ	2	I	7	J 0	0127 TO 0130
PUNCH P					
WIJ	2	I	7	J 0	0177 TO 0179
PUNCH W					
A	PUNCH W				0180
D	PUNCH W				0181
N	PUNCH W				0182
R	PUNCH W				0183
MC	PUNCH W				0184
LOWER CASE C					
M	PUNCH L				0227
Y	PUNCH L				0228
LOWER CASE Y					
R	PUNCH L				0229
LOWER CASE R					

1		BLR	1000	1999					
2		REG	H0001	0012	READ				
3		REG	Z0013	0024	READ				
4		REG	A0025	0036	READ				
5		REG	S0037	0050	READ				
6		REG	B0051	0062					
7		REG	T0063	0074					
8		REG	X0077	0086	PUNCH XI				
9		REG	P0127	0136	PUNCH XIJ				
10		REG	W0177	0186	PUNCH W,MC				
11		REG	L0227	0236	PUNCH MYR				
12		REG	R0327	0236					
13		REG	F0100	0111					
14		REG	C0112	0123					
15		SYN	START	1950					
16		SYN	HALT	0000					
17	START	RSP	0012	LOOP2		1950	83	0012	0156
18	LOOP2	RAU	H0013	B		0156	60	4013	0167
		FSR	Z0013	B		0167	33	4025	0151
20		FMP	A0013	B		0151	39	4037	0087
21		STU	B0013	B		0087	21	4063	0166
22		LDD	PFTF			0166	69	0169	0172

23		STD	1950		0172	24	1950	0153
24		AXP	0001		0153	52	0001	0159
25		NZR	LOOP2	1961	0159	42	0156	1961
6	PFTF	RSP	0012	RFTP1	0160	82	0012	0075
27	RETR1	RAU	H0013	F	0075	60	4013	0217
28		FSB	Z0013	B	0217	23	4025	0201
29		FMP	A0013	B	0201	39	4037	0137
30		STU	C0013	B	0137	21	4124	0277
31		AXR	0001		0277	52	0001	0283
32		NZR	RETR1		0283	42	0075	0187
33		RSP	0012	RFTP2	0187	83	0012	0093
34	RETR2	RAU	C0013	B	0093	60	4124	0270
35		FSB	B0013	B	0279	33	4063	0089
36		STU	T0013	B	0089	21	4075	0278
37		AXR	0001		0279	52	0001	0284
38		NZR	RETR2		0284	42	0093	0088
39		RAU	T0004		0088	60	0066	0171
40		FDV	S0002		0171	34	0038	0138
41		STU	F0002		0138	21	0101	0154
42		RAU	T0009		0154	60	0071	0125
43		FDV	S0006		0125	34	0042	0092
44		STU	F0004		0092	21	0103	0206
45		RAU	T0010		0206	60	0072	0377
46		FDV	S0009		0377	34	0045	0095
47		STU	F0006		0095	21	0105	0158
48		RAU	T0011		0158	60	0073	0427
49		FDV	S0010		0427	34	0045	0096
50		STU	F0007		0096	21	0106	0209
51		FAD	F0002		0209	32	0101	0477
52		FAD	F0004		0477	32	0103	0379
53		FAD	F0006		0379	32	0105	0281
54		STU	SUMF		0281	21	0286	0139
55		RAU	F0002		0139	60	0101	0155
56		FDV	SUMF		0155	34	0286	0386
57		STU	P0001		0386	21	0127	0280
58		RAU	F0004		0280	60	0103	0157
59		FDV	SUMF		0157	34	0286	0436
60		STU	P0002		0436	21	0128	0381
61		RAU	F0006		0381	60	0105	0250
62		FDV	SUMF		0259	34	0286	0486
63		STU	P0003		0486	21	0129	0282
64		RAU	F0007		0282	60	0106	0161
65		FDV	SUMF		0161	34	0286	0536
66		STU	P0004		0536	21	0130	0383
67		RAU	P0002		0383	60	0128	0433
68		FSR	01		0433	33	0586	0163
69	NEXT	NZU	NEXT	CONT	0163	44	0267	0168
70		RMI	CONT		0267	46	0168	0221
71		RAU	P0002		0221	60	0128	0483
72		FDV	P780H		0483	34	0636	0686
73		FAD	ONF		0686	32	0189	0165
74		STU	BOTT1		0165	21	0170	0173
75		RAU	P0002		0173	60	0128	0533
76		FMP	P268C		0533	39	0736	0786
77		FAD	P0003		0786	32	0129	0205
78		FDV	BOTT1		0205	34	0170	0220
79		STU	P0003		0220	21	0129	0382
80		RAU	P0002		0382	60	0128	0583

81	FMP	P119F		0583	39	0836	0886	
82	FAD	P0003		0886	32	0129	0255	
	FDV	P0111		0255	24	0170	0270	
85	STU	P0004	x 7,0	0270	21	0130	0633	
86	RAU	P0001		0632	60	0127	0431	
87	FDV	P0111		0431	34	0170	0320	
88	STU	P0001	x 2,0	0320	21	0127	0380	
89	RAU	ZERO		0380	60	0683	0237	
90	STU	P0002	CONT	x 4,0	0237	21	0128	0168
	RAU	4P003		0168	60	0271	0175	
91	FMP	P0001		0175	39	0127	0527	
92	STU	TERM1		0527	21	0432	0285	
93	RAU	28016		0285	60	0188	0143	
94	FMP	P0002		0143	39	0128	0378	
95	FAD	TERM1		0378	32	0432	0309	
96	STU	TERM1		0309	21	0432	0385	
97	RAU	32P0		0385	60	0238	0193	
98	FMP	P0003		0193	39	0129	0429	
99	FAD	TERM1		0429	32	0432	0359	
100	STU	TERM1		0359	21	0432	0435	
101	RAU	39944		0435	60	0288	0243	
102	FMP	P0004		0243	39	0130	0430	
103	FAD	TERM1		0430	32	0432	0409	
104	STU	N		0409	21	0164	0317	
105	RAU	P0001		0317	60	0127	0481	
106	FMP	4P003		0481	39	0271	0321	
107	FDV	N		0321	34	0164	0214	
108	STU	W0001		0214	21	0177	0480	
	RAU	P0004		0480	60	0130	0485	
110	FMP	39944		0485	39	0288	0338	
111	FDV	N		0338	34	0164	0264	
112	STU	W0003		0264	21	0179	0482	
113	LDD	PETF2		0482	60	0535	0388	
114	STD	1950		0388	24	1950	0203	
115	PCH	P0001		0203	71	0127	0577	
116	PCH	W0001	1961	0577	71	0177	1961	
117	PETE2	RSR	0012 RFTR3	0535	83	0012	0091	
118	RETR3	RAU	H0013 B	0091	60	4013	0367	
119		FSR	Z0013 P	0367	22	4025	0251	
120		FMP	A0013 P	0251	29	4037	0287	
121		STU	C0013 B	0287	21	4124	0627	
122		AXB	0001	0627	52	0001	0733	
123		NZR	RFTR3	0732	42	0091	0337	
124		RSR	0012 RFTR4	0337	83	0012	0293	
125	RETR4	RAU	C0013 B	0293	60	4124	0479	
126		FSR	B0013 B	0479	22	4063	0239	
127		STU	T0013 B	0229	21	4075	0428	
128		AXB	0001	0428	52	0001	0384	
129		NZR	RETR4	0384	42	0293	0438	
130		RAU	T0002	0438	60	0064	0219	
131		FDV	S0001	0219	34	0037	0387	
132		STU	F0001	F 1	0387	21	0100	0253
133		RAU	T0004		0253	60	0066	0371
134		FDV	S0002		0371	34	0038	0488
135		STU	F0002	F 2	0488	21	0101	0204
136		RAU	T0007		0204	60	0069	0223
137		FDV	S0005		0222	34	0041	0141
138		STU	F0003	F 3	0141	21	0102	0305

139	RAU	T0010			0305	60	0072	0677
140	FDV	S0009			0677	34	0045	0145
141	STU	F0006		F 6	0145	21	0105	0208
142	RAU	T0011			0208	60	0073	0727
143	FDV	S0010			0727	34	0046	0146
144	STU	F0007		F 7	0146	21	0106	0459
145	RAU	T0012			0459	60	0074	0529
146	FDV	S0011			0529	34	0047	0097
147	STU	F0008		F 8	0027	21	0107	0160
148	FMP	S0008			0160	39	0044	0094
149	STU	E8598			0094	21	0098	0301
150	RAU	T0009			0301	60	0071	0225
151	FSR	E8598			0225	33	0098	0275
152	STU	L			0275	21	0530	0783
153	RAU	S0006			0783	60	0042	0147
154	FDV	S0003			0147	34	0039	0289
155	STU	GOON			0289	21	0144	0197
156	FMP	S0004			0197	39	0040	0090
157	STU	S659			0090	21	0194	0247
158	RAU	S0007			0247	60	0043	0297
159	FSR	S659			0297	33	0194	0421
160	STU	LOW1			0421	21	0076	0579
161	RAU	GOON			0577	60	0144	0099
162	FMP	T0006			0099	39	0068	0218
163	STU	UPPER			0218	21	0222	0325
164	RAU	L			0325	60	0530	0585
165	FSR	UPPER			0585	33	0222	0149
166	FDV	LOW1			0149	34	0076	0126
167	STU	F0005		F 5	0126	21	0104	0207
168	FMP	S0004			0207	39	0040	0140
169	STU	S6F5			0140	21	0244	0347
170	RAU	T0006			0347	60	0068	0273
171	FSR	S6F5			0273	33	0244	0471
172	FDV	S0003			0471	34	0039	0339
173	STU	F0004		F 4	0339	21	0103	0256
174	RAU	ZFRO			0256	60	0583	0437
175	STU	SUMF			0437	21	0286	0389
176	RSB	0008	LOOP3		0389	83	0008	0195
177	RAU	F0009 B			0195	60	4108	0213
178	FAD	SUMF			0213	32	0286	0263
179	STU	SUMF		SUM F	0263	21	0286	0439
180	AXB	0001			0439	52	0001	0245
181	NZB	LOOP3			0245	42	0195	0199
182	RSA	0008	LOOP4		0199	81	0008	0355
183	RAU	F0009 A			0355	60	2108	0313
184	FDV	SUMF			0313	34	0286	0936
185	STU	X0009 A			0936	21	2085	0538
186	AXA	0001			0538	50	0001	0294
187	NZA	LOOP4			0294	40	0355	0148
188	RAU	X0001			0148	60	0077	0531
189	FMP	2P016			0531	39	0434	0484
190	STU	SUMX			0484	21	0588	0191
191	RAU	X0002			0191	60	0078	0833
192	FMP	4P003			0833	39	0271	0521
193	FAD	SUMX			0521	32	0588	0215
194	STU	SUMX			0215	21	0588	0241
195	RAU	X0003			0241	60	0079	0883
196	FMP	18016			0883	39	0986	0487

197	FAD	SUMX		0487	32	0588	0265
198	STU	SUMX		0265	21	0588	0291
199	RAU	X0004		0291	60	0080	0635
200	FMP	28016		0635	32	0188	0638
201	FAD	SUMY		0638	32	0588	0315
202	STU	SUMX		0315	21	0588	0341
203	RAU	X0005		0341	60	0081	0685
204	FMP	28010		0685	39	0688	0738
205	FAD	SUMX		0738	32	0588	0365
206	STU	SUMY		0365	21	0588	0391
207	RAU	X0006		0391	60	0082	0537
208	FMP	32P0		0537	39	0238	0788
209	FAD	SUMX		0788	32	0588	0415
210	STU	SUMX		0415	21	0588	0441
211	RAU	X0007		0441	60	0083	0587
212	FMP	39944		0587	39	0288	0838
213	FAD	SUMX		0838	32	0588	0465
214	STU	SUMX		0465	21	0588	0491
215	RAU	X0008		0491	60	0084	0489
216	FMP	44010		0489	39	0142	0192
217	FAD	SUMX		0192	32	0588	0515
218	STU	W0006	N	0515	21	0182	0735
219	RAU	X0004		0735	60	0080	0785
220	FMP	37099		0785	39	0888	0938
221	FDV	W0006		0938	34	0182	0532
222	STU	W0004	A	0532	21	0180	0933
223	RAU	X0005		0933	60	0081	0835
224	FAD	X0008		0835	32	0084	0211
225	STU	X5X8		0211	21	0216	0269
226	RAU	X0001		0260	60	0077	0581
227	FAD	X0003		0581	32	0079	0405
228	FDV	X5X8		0405	34	0216	0266
229	FMP	TWO		0266	39	0319	0369
230	STU	W0005	D	0369	21	0181	0534
231	RAU	X0002		0534	60	0078	0983
232	FDV	W0006		0983	34	0182	0582
233	FMP	4P003		0582	39	0271	0571
234	STU	J2	W 2	0571	21	0176	0629
235	RAU	X0007		0629	60	0083	0637
236	FMP	39944		0637	39	0288	0988
237	FDV	W0006		0988	34	0182	0632
238	STU	J7	W 7	0632	21	0687	0190
239	RAU	W0003		0190	60	0179	0584
240	FDV	W0001		0584	34	0177	0777
241	STU	W7W2		0777	21	0682	0885
242	RAU	J7		0885	60	0687	0541
243	FDV	J2		0541	34	0176	0226
244	FSR	W7W2		0226	33	0682	0509
245	FMP	W0001		0509	39	0177	0827
246	FDV	1288		0827	34	0580	0630
247	STU	GOON1		0630	21	0634	0737
248	FAD	ONF		0737	32	0189	0565
249	FMP	S0012		0565	39	0048	0198
250	FAD	ONF		0198	32	0189	0615
251	STU	DFNR		0615	21	0370	0323
252	RAU	GOON1		0323	60	0634	0539
253	FMP	S0012		0539	39	0048	0248
254	FDV	DFNR		0248	34	0370	0420

255	STU	W0007	R	0420	21	0193	0787	
256	RAU	X5X8		0787	60	0216	0621	
257	FMP	3752		0621	39	0124	0174	
258	STU	3X5X8		0174	21	0478	0631	
259	RAU	X0001		0631	60	0077	0681	
260	FAD	X0003		0681	32	0079	0456	
261	FMP	63		0455	39	0258	0308	
262	FAD	3X5X8		0308	32	0478	0505	
263	STU	DFNMC		0505	21	0210	0363	
264	RAU	X0003		0363	60	0079	0684	
265	FMP	F1VF		0684	39	0837	0887	
266	STU	Y11		0887	21	0242	0295	
267	RAU	X0005		0295	60	0081	0935	
268	FMP	FIVE		0935	39	0837	0937	
269	FAD	Y11		0937	32	0242	0419	
270	STU	Y11		0419	21	0242	0345	
271	RAU	X0006		0345	60	0082	0987	
272	FAD	Y11		0987	32	0242	0469	
273	STU	Y11		0469	21	0242	0395	
274	RAU	X0008		0395	60	0084	0589	
275	FAD	Y11		0589	32	0242	0519	
276	STU	Y11		0519	21	0242	0445	
277	RAU	P268C		0445	60	0736	0591	
278	FMP	X0004		0591	39	0080	0680	
279	FAD	Y11		0680	32	0242	0569	
280	FDV	DFNMC		0569	34	0210	0260	
281	STU	W0008	MC	0260	21	0184	0629	
282	RAU	S0012		0539	60	0048	0303	
283	STU	L0001	M	0303	21	0227	0730	
284	RAU	S0013		0730	60	0049	0353	
285	STU	L0002	Y	0353	21	0228	0731	
286	RAU	S0014		0731	60	0050	0555	
287	STU	L0003	R	0555	21	0229	0732	
288	LDD	PETE3		0732	69	0985	0689	
289	STD	1950		0689	24	1950	0402	
290	PCH	X0001		0403	71	0077	0877	
291	PCH	L0001		0877	71	0227	0927	
292	PCH	W0001	1961	0927	71	0177	1961	
293	PFTF3	RSR	0012	LOOPA	0985	83	0012	0641
294	LOOPA	RAU	H0013	R	0641	60	4013	0417
295		FSP	Z0013	R	0417	33	4025	0251
296		FMP	A0013	R	0351	39	4037	0739
297		STU	P0013	R	0739	21	4063	0316
298		LDD	PFTF4		0316	69	0619	0272
299		STD	1950		0272	24	1950	0452
300		AXR	0001		0453	52	0001	0559
301		NZR	LOOPA	1961	0559	42	0641	1961
302	PFTF4	RSR	0012	RFTR5	0619	83	0012	0375
303	RET5	RAU	H0013	R	0375	60	4013	0467
304		FSP	Z0013	R	0367	33	4025	0401
305		FMP	A0013	R	0401	39	4037	0789
306		STU	C0013	R	0789	21	4124	0977
307		AXR	0001		0277	52	0001	0734
308		NZR	RFTR5		0734	42	0375	0839
309		RAU	C0004		0839	60	0115	0669
310		FSP	B0004		0669	33	0054	0781
311		STU	T4		0781	21	0889	0292
312		RAU	C0008		0292	60	0119	0373

313	FSR	P0008		0373	33	0058	0939
314	STU	T8		0939	21	0344	0397
315	RAU	C0009		0397	60	0120	0425
316	FSR	P0009		0425	33	0059	0989
317	STU	T9		0989	21	0394	0447
318	RAU	C0010		0447	60	0121	0475
319	FSR	P0010		0475	33	0060	0240
320	STU	T10		0240	21	0444	0497
321	RAU	T4		0497	60	0889	0243
322	FDV	S0002		0343	34	0038	0290
323	STU	F2	F 2	0290	21	0494	0547
324	RAU	T8		0547	60	0344	0249
325	FDV	S0006		0249	34	0042	0342
326	STU	F4	F 4	0342	21	0196	0299
327	RAU	T9		0299	60	0394	0349
328	FDV	S0009		0349	34	0045	0495
329	STU	F6	F 6	0495	21	0150	0503
330	RAU	T10		0503	60	0444	0399
331	FDV	S0010		0399	34	0046	0246
332	STU	F7	F 7	0246	21	0200	0553
333	RAU	ZERO		0553	60	0683	0240
334	STU	SUMF		0340	21	0286	0390
335	FAD	F2		0390	32	0494	0671
336	FAD	F4		0671	32	0196	0423
337	FAD	F6		0423	32	0150	0528
338	FAD	F7		0528	22	0200	0579
339	STU	SUMF		0578	21	0286	0440
340	RAU	F2		0440	60	0494	0449
341	FDV	SUMF		0449	34	0286	0490
342	STU	P0001		0490	21	0127	0780
343	RAU	F4		0780	60	0196	0451
344	FDV	SUMF		0451	34	0286	0540
345	STU	P0002		0540	21	0128	0831
346	RAU	F6		0821	60	0150	0605
347	FDV	SUMF		0605	34	0286	0590
348	STU	P0003		0590	21	0129	0782
349	RAU	F7		0782	60	0200	0655
350	FDV	SUMF		0655	34	0286	0640
351	STU	P0004		0640	21	0130	0784
352	RAU	P0002		0784	60	0128	0834
353	FSR	01		0834	33	0586	0413
354	NZU	NEXT4	CONT3	0413	44	0517	0268
355	NEXT4	PMI	CONT3	0517	46	0268	0721
356	RAU	P0002		0721	60	0128	0884
357	FDV	P780H		0884	34	0626	0690
358	FAD	ONF		0690	32	0189	0665
359	STU	P0TT3		0665	21	0470	0473
360	RAU	P0002		0473	60	0128	0934
361	FMP	P26BC		0934	30	0726	0740
362	FAD	P0003		0740	32	0129	0705
363	FDV	P0TT3		0705	34	0470	0520
364	STU	P0003		0520	21	0129	0832
365	RAU	P119F		0832	60	0836	0691
366	FMP	P0002		0691	30	0128	0628
367	FAD	P0004		0628	32	0130	0257
368	FDV	P0TT3		0257	34	0470	0570
369	STU	P0004		0570	21	0130	0984
370	RAU	P0001		0984	60	0127	0881

371	FDV	P0013		0891	34	0470	0620
372	STU	P0001		0620	21	0127	0830
373	RAU	ZERO		0830	60	0683	0790
374	STU	P0002	CONT3	0790	21	0128	0268
375	RAU	P0001		0268	60	0127	0931
376	FMP	4P003		0931	39	0271	0771
377	STU	TERMF		0771	21	0276	0679
378	RAU	P0002		0679	60	0128	0840
379	FMP	28016		0840	39	0188	0890
380	FAD	TERMF		0890	32	0276	0603
381	STU	TERMF		0603	21	0276	0729
382	RAU	P0003		0729	60	0129	0940
383	FMP	32P0		0940	39	0238	0990
384	FAD	TERMF		0990	32	0276	0653
385	STU	TERMF		0651	21	0276	0779
386	RAU	P0004		0779	60	0130	0741
387	FMP	39944		0741	39	0288	0791
388	FAD	TERMF		0791	32	0276	0703
389	STU	N	N	0703	21	0164	0567
390	RAU	P0001		0567	60	0127	0981
391	FMP	4P003		0981	39	0271	0821
392	FDV	N		0821	34	0164	0314
393	STU	W0001	W200	0314	21	0177	0880
394	RAU	P0004		0880	60	0130	0841
395	FMP	39944		0841	39	0288	0891
396	FDV	N		0891	34	0164	0364
397	STU	W0003	W700	0364	21	0179	0882
398	LDD	PFTE5		0882	69	0941	0544
399	STD	1950		0544	24	1 50	0752
400	PCH	P0001		0753	71	0127	0678
401	PCH	W0001	1961	0678	71	0177	1961
402	PFTE5	RSA 0012	LOOP5	0941	81	0012	0597
403	LOOP5	RAU H0013 A		0597	60	2013	0617
404		FSR Z0013 A		0617	33	2025	0501
405		FMP A0013 A		0501	39	2037	0991
406		STU C0013 A	C	0991	21	2124	0728
407		AXA 0001		0728	50	0001	0392
408		NZA LOOP5		0392	40	0597	0296
409		RSA 0012	LOOP6	0296	81	0012	0152
410	LOOP6	RAU C0013 A		0152	60	2124	0829
411		FSR B0013 A		0829	33	2063	0442
412		STU T0013 A		0442	21	2075	0778
413		AXA 0001		0778	50	0001	0492
414		NZA LOOP6		0492	40	0152	0346
415		RAU T0002		0346	60	0064	0719
416		FDV S0001		0719	34	0037	0542
417		STU F0001	F 1	0542	21	0100	0803
418		RAU T0004		0803	60	0066	0871
419		FDV S0002		0871	34	0038	0592
420		STU F0002	F 2	0592	21	0101	0254
421		RAU T0006		0254	60	0068	0523
422		FDV S0005		0523	34	0041	0642
423		STU F0003	F 3	0642	21	0102	0755
424		RAU T0008		0755	60	0070	0525
425		FDV S0006		0525	34	0042	0692
426		STU F0004	F 4	0692	21	0103	0306
427		RAU T0009		0306	60	0071	0575
428		FDV S0009		0575	34	0045	0545

429	STU	F0006	F 6	0545	21	0105	0358
430	RAU	T0010		0258	60	0072	0828
431	FDV	S0010		0828	34	0046	0396
432	STU	F0007	F 7	0396	21	0106	0609
433	RSA	0007		0609	81	0007	0715
434	RAU	ZERO		0715	60	0683	0742
435	STU	SUMF	LOOP7	0742	21	0286	0792
436	RAU	F0008 A		0792	60	2107	0261
437	FAD	SUMF		0261	32	0286	0463
438	STU	SUMF		0463	21	0286	0842
439	AXA	0001		0842	50	0001	0298
440	NZA	LOOP7		0298	40	0792	0202
441	RAU	SUMF		0202	60	0286	1807
441	FSR	F0005		1807	33	0104	1800
441	STU	SUMF		1800	21	0286	1801
441	RSA	0007	LOOP9	1801	81	0007	0408
442	RAU	F0008 A		0408	60	2107	0311
443	FDV	SUMF		0311	34	0286	0892
444	STU	X0008 A		0892	21	2084	0942
445	AXA	0001		0942	50	0001	0348
446	NZA	LOOP9		0348	40	0408	0252
447	RAU	ZERO		0252	60	0683	0992
448	STU	SUMX		0992	21	0588	0393
449	RAU	X0001		0293	60	0077	0932
450	FMP	2P016		0932	39	0434	0443
451	FAD	SUMX		0443	32	0588	0765
452	STU	SUMX		0765	21	0588	0493
453	RAU	4P003		0493	60	0271	0625
454	FMP	X0002		0625	30	0078	0878
455	FAD	SUMX		0878	32	0588	0815
456	STU	SUMX		0815	21	0588	0543
457	RAU	18016		0543	60	0985	0593
458	FMP	X0003		0593	39	0079	0879
459	FAD	SUMX		0879	32	0588	0865
460	STU	SUMX		0865	21	0588	0643
461	RAU	28016		0643	60	0188	0693
462	FMP	X0004		0692	39	0080	0930
463	FAD	SUMX		0930	32	0588	0915
464	STU	SUMX		0915	21	0588	0743
465	RAU	32P0		0743	60	0238	0793
466	FMP	X0006		0793	39	0082	0982
467	FAD	SUMX		0982	32	0588	0965
468	STU	SUMX		0965	21	0588	0843
469	RAU	39944		0843	60	0288	0893
470	FMP	X0007		0993	39	0083	0942
471	FAD	SUMX		0943	32	0588	0366
472	STU	N	N	0366	21	0164	0667
472	STU	W0006		0667	21	0182	1810
473	RAU	X0004		1810	60	0080	0993
474	FMP	37099		0993	39	0888	0594
475	FDV	N		0594	34	0164	0414
476	STU	W0004	A	0414	21	0180	0644
477	RAU	X0002		0644	60	0078	0694
478	FMP	4P003		0694	39	0271	0921
4	FDV	N		0921	34	0164	0464
480	STU	J2	W 2	0464	21	0176	0929
481	RAU	X0007		0929	60	0083	0744
482	FMP	39944		0744	39	0288	0794

483	FDV	N		0794	34	0164	0514	
484	STU	J7		0514	21	0687	0844	
485	RAU	W0003	W 7	0844	60	0179	0894	
486	FDV	W0001		0894	34	0177	0928	
487	STU	W7W2		0928	21	0682	0944	
488	RAU	J7		0944	60	0687	0994	
489	FDV	J2		0994	34	0176	0326	
490	FSR	W7W2		0326	32	0682	0659	
491	FMP	W0001		0659	39	0177	0978	
492	FDV	1288		0978	34	0580	0980	
493	STU	BOTT4		0980	21	0595	0398	
494	FAD	ONF		0398	32	0189	0416	
495	FMP	S0012		0416	39	0048	0448	
496	FAD	ONF		0448	32	0189	0466	
497	STU	BOTT4		0466	21	0670	0573	
498	RAU	BOTT4		0573	60	0595	0499	
499	FMP	S0012		0499	39	0048	0498	
500	FDV	BOTT4		0498	34	0670	0720	
501	STU	W0007	R	0720	21	0183	0645	
502	RAU	X0001		0645	60	0077	0695	
503	FAD	X0003		0695	32	0079	0805	
504	STU	X1X3		0805	21	0310	0513	
505	RAU	X0003		0513	60	0079	0745	
506	FMP	FIVE		0745	39	0837	0795	
507	STU	QTMC		0795	21	0250	0853	
508	RAU	X0006		0853	60	0082	0845	
509	FAD	QTMC		0845	32	0250	0979	
510	STU	QTMC		0979	21	0250	0903	
5	RAU	X0004		0903	60	0080	0895	
512	FMP	P268C		0895	39	0736	0945	
513	FAD	QTMC		0945	32	0250	0995	
514	FMP	15873		0995	39	0548	0598	
515	FDV	X1X3		0598	34	0310	0360	
516	STU	W0008	MC	0360	21	0184	0446	
517	RAU	S0012		0446	60	0048	0953	
518	STU	L0001	M	0953	21	0227	0496	
519	RAU	S0013		0496	60	0049	0304	
520	STU	L0002	Y	0304	21	0228	0546	
521	RAU	S0014		0546	60	0050	0855	
522	STU	L0003	R	0855	21	0229	0596	
523	PCH	X0001		0596	71	0077	0646	
524	PCH	L0001		0646	71	0227	0696	
525	PCH	W0001	HALT	0696	71	0177	0000	
526	01	10	0000	0049	0586	10	0000	0049
527	ONE	10	0000	0051	0189	10	0000	0051
528	ZFP0	00	0000	0000	0683	00	0000	0000
529	4P003	40	0200	0051	0271	40	0300	0051
530	28016	28	0160	0052	0189	28	0160	0052
531	32P0	32	0000	0052	0238	32	0000	0052
532	39944	39	9440	0052	0288	39	9440	0052
533	18016	18	0160	0052	0986	18	0160	0052
534	28010	28	0100	0052	0688	28	0100	0052
535	44010	44	0100	0052	0142	44	0100	0052
5	1288	12	8800	0049	0580	12	8800	0049
5	TWO	20	0000	0051	0319	20	0000	0051
538	3753	37	5300	0050	0124	37	5300	0050
539	63	63	0000	0049	0258	63	0000	0049
540	FIVE	50	0000	0050	0837	50	0000	0050

541	15873	15	8730	0052	0548	15	8730	0052
542	P268C	-	8300	0050	0736	-	8300	0050
	P7804	-	0800	0050	0626	-	0800	0050
544	P119F	-	9600	0049	0837	-	9600	0049
545	2P016	20	1600	0051	0434	20	1600	0051
546	37099	37	0990	0052	0888	37	0990	0052

## IBM 650 7 PER CARD

6919541953+	547	2400008000+	1999999999+		
6919531952+	2419611954+	7019621950+	6919561955+	2	
6919531952+	2419631954+	3000011964+	6919561955+	2	
6919531952+	2419651954+	6580021966+	6919561955+	2	
6919531952+	2419671954+	8280031968+	6919561955+	2	
6919531952+	2419691954+	6979501970+	6919561955+	2	
6919531952+	2419711954+	5300011972+	6919561955+	2	
6919531952+	2419731954+	5000011974+	6919561955+	2	
	17+	1000000052+	1500000052+	4000000051+	7
	85+	1000000052+	5450000052+	3900000052+	1
	137+	1000000052+	1000000052+	4000000051+	6
	205+	1000000052+	1000000052+	1000000052+	1
	257+	1000000051+	1000000051+	1000000051+	1
	325+	1000000051+	2000000051+	1000000051+	1
	17+	4000000051+	1500000052+	4000000051+	2
	85+	1000000052+	6250000052+	4660000052+	4
	137+	4000000051+	1000000052+	4000000051+	6
	205+	1000000052+	1000000052+	1000000052+	1
	257+	1000000051+	1000000051+	1000000051+	1
	325+	1000000051+	2000000051+	3000000053+	1
	377+	3936000052+	1670000052+	7224000051+	2
	447+	7248000051+	7675000052+	1231000052+	1
	17+	1000000052+	4850000052+	4000000051+	1
	85+	1000000052+	5000000052+	8500000052+	6
	137+	1000000052+	1000000052+	4000000051+	6
	205+	1000000052+	1000000052+	1000000052+	1
	257+	1000000051+	1000000052+	1000000051+	1
	325+	1000000051+	2000000053+	1000000051+	3
	17+	1000000052+	2000000052+	4000000051+	6
	85+	6500000052+	1540000052+	1400000052+	2
	137+	1000000052+	1000000052+	4000000051+	6
	205+	1000000052+	1000000052+	1300000052+	2
	257+	1000000051+	1000000051+	1000000051+	1
	325+	1000001051+	1000000051+	1000000051+	1
	17+	1000000052+	2000000052+	4000000051+	4
	85+	6730000052+	7020000052+	2900000052+	2
	137+	1000000052+	1000000052+	4000000051+	9
	205+	1000000052+	1000000052+	1300000052+	2
	257+	1000000051+	1000000051+	1000000051+	3
	325+	3000000051+	1000000053+	1000000051+	1
	377+	3936000052+	1670000052+	7224000051+	2
	447+	7248000051+	7675000052+	1231000052+	1
	17+	1000000052+	7610000052+	4000000051+	4
	85+	3940000052+	7400000052+	1240000052+	2
	137+	1000000052+	1000000052+	4000000051+	9
	205+	1000000052+	1000000052+	1300000052+	2
	257+	1000000051+	1000000053+	1000000051+	3
	325+	1000000051+	1000000051+	1000000051+	1

A

7	2400008000+	199999999+	HALT 01	9999 999	9	
4+	7019621950+	6919561955+	2419628000+	6019511963+		1
4+	3000011964+	6919561955+	2419648000+	8080021965+		2
4+	6580021966+	6919561955+	2419668000+	3500011967+		3
4+	8280031968+	6919561955+	2419688000+	8800021969+		4
4+	6979501970+	6919561955+	2419708000+	2420001971+		5
4+	5200011972+	6919561955+	2419728000+	4219731961+		6
4+	5000011974+	6919561955+	2419741961+	5800011969+		7
2+	1500000052+	4000000051+	7000000051+	1000000052+	2050000052+	3600000052+
2+	5450000052+	3000000052+	1600000052+	2000000052+	0 0	21+
2+	1000000052+	4000000051+	6000000051+	1000000052+	1000000052+	1000000052+
2+	1000000052+	1000000052+	1300000052+	1100000052+		
1+	1000000051+	1000000051+	1000000051+	1000000051+	1000000051+	3000000051+
1+	2000000051+	1000000051+	1000000051+	1000000051+		
1+	1500000052+	4000000051+	2940000052+	1000000052+	2050000052+	3600000052+
12+	6250000052+	4660000052+	4600000052+	2000000052+	0 1	21+
11+	1000000052+	4000000051+	6000000051+	1000000052+	1000000052+	1000000052+
12+	1000000052+	1000000052+	1300000052+	1100000052+		
11+	1000000051+	1000000051+	1000000051+	1000000051+	1000000051+	3000000051+
61+	2000000051+	3000000053+	1000000051+	1000000051+		
32+	1670000052+	7224000051+	2663000050+	8671000052+	1000000053+	9947000052+
61+	7675000052+	1231000052+	1143000052+	1900000051+	6000000052+	3000000051+
32+	4850000052+	4000000051+	1800000052+	1000000052+	7750000052+	5430000052+
32+	5000000052+	8500000052+	6460000052+	4810000052+	0 2	21+
32+	1000000052+	4000000051+	6000000051+	1000000052+	1000000052+	1000000052+
32+	1000000052+	1000000052+	1000000052+	1000000052+		
61+	1000000052+	1000000051+	1000000051+	1000000052+	1000000052+	1000000053+
61+	2000000053+	1000000051+	2000000051+	1000000053+		
32+	2000000052+	4000000051+	6000000051+	1000000052+	3600000052+	1000000052+
32+	1540000052+	1400000052+	2000000051+	2000000051+	0 0	22+
32+	1000000052+	4000000051+	6000000051+	1000000052+	1000000052+	1000000052+
32+	1000000052+	1200000052+	2000000051+	2000000051+		
61+	1000000051+	1000000051+	1000000051+	1000000051+	2000000051+	1000000051+
61+	1000000051+	1000000051+	1000000052+	1000000052+		
32+	2000000052+	4000000051+	4730000052+	1000000052+	3600000052+	1000000052+
32+	7020000052+	2800000052+	2000000051+	2000000051+	0 3	22+
32+	1002000052+	4000000051+	9000000051+	1000000052+	1000000052+	1000000052+
32+	1000000052+	1300000052+	2000000051+	2000000051+		
61+	1000000051+	1000000051+	3000000051+	1000000051+	3000000051+	1000000051+
61+	1000000053+	1000000051+	1000000052+	1000000052+		
32+	1670000052+	7224000051+	2663000050+	8671000052+	1000000053+	9947000052+
61+	7675000052+	1231000052+	1143000052+	2500000051+	6000000052+	3000000051+
32+	7610000052+	4000000051+	4730000052+	1000000052+	4760000052+	1000000052+
52+	7400000052+	1240000052+	2000000051+	2000000051+	0 4	22+
52+	1000000052+	4000000051+	9000000051+	1000000052+	1000000052+	1000000052+
52+	1000000052+	1300000052+	2000000051+	2000000051+		
61+	1000000053+	1000000051+	3000000051+	1000000051+	3000000053+	1000000051+
61+	1000000051+	1000000051+	1000000052+	1000000052+		

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45	FSR	B0011		0145	33	0047	0123	
46	STU	T11		0123	21	0228	0231	
47	RAU	T9		0231	60	0076	0281	
48	FDV	P780H		0281	34	0284	0334	
49	FMP	MIN1		0334	30	0187	0237	
50	STU	P9		0237	21	0092	0195	
51	RAU	100		0195	60	0098	0103	
52	STU	S0006	6 9.4	0103	21	0082	0185	
53	RAU	T6		0185	60	0074	0229	
54	FMP	100		0229	39	0098	0148	
55	FDV	T9		0148	34	0076	0126	
56	STU	S0003	6 6.4	0126	21	0079	0182	
57	RAU	T10		0182	60	0178	0233	
58	FMP	100		0233	39	0098	0198	
59	FDV	P268C		0198	34	0101	0151	
60	FMP	MIN1		0151	39	0187	0287	
61	FDV	T9		0287	24	0076	0176	
62	STU	I0001	10.6	0176	21	0127	0230	
63	RAU	T11		0230	60	0228	0283	
64	FMP	100		0283	39	0098	0248	
65	FDV	1196		0248	24	0201	0251	
66	FDV	T9		0251	34	0076	0226	
67	STU	I0002	11.7	0226	21	0128	0331	
68	LDD	G01		0331	69	0384	0337	
69	STD	1950	1961	0337	24	1950	1961	
70	G01	RAU	H0006	START Q2	0384	60	0006	0111
71		FSR	Z0006		0111	33	0018	0245
72		FMP	A0006		0245	39	0030	0280
73		STU	C6		0280	21	0184	0387
74		RAU	H0009		0387	60	0009	0113
75		FSR	Z0009		0113	33	0021	0147
76		FMP	A0009		0147	39	0033	0333
77		STU	C9		0233	21	0088	0191
78		RAU	H0010		0191	60	0010	0165
79		FSR	Z0010		0165	33	0022	0149
80		FMP	A0010		0149	39	0034	0434
81		STU	C10		0434	21	0138	0241
82		RAU	C6		0241	60	0184	0130
83		FSR	B0006		0139	33	0042	0119
84		STU	T6		0119	21	0074	0227
85		RAU	C9		0227	60	0088	0242
86		FSR	B0009		0243	33	0045	0121
87		STU	T9		0121	21	0076	0272
88		RAU	C10		0279	60	0138	0292
89		FSR	B0010		0293	33	0046	0173
90		STU	T10		0173	21	0178	0381
91		RAU	T9		0381	60	0076	0431
92		FDV	S0006		0431	34	0082	0232
93		STU	F4		0232	21	0086	0189
94		RAU	T10		0189	60	0178	0383
95		FDV	I0001		0383	34	0127	0277
96		STU	F6		0277	21	0282	0235
97		FAD	F4		0235	22	0086	0162
98		STU	F4+6		0163	21	0068	0171
99		RAU	F6		0171	60	0282	0437
100		FDV	F4+6		0437	34	0068	0118
101		STU	X6	X 6	0118	21	0072	0075
102		FDV	P209F		0075	34	0278	0328

103	FAD	ONF		0328	32	0481	0057	
104	STU	BOT1		0057	21	0052	0215	
105	RAU	T10		0215	60	0178	0433	
106	FMP	S0006		0433	29	0082	0332	
107	FMP	3P727		0332	39	0285	0335	
108	FDV	I0001		0325	34	0127	0327	
109	FAD	T9		0327	22	0076	0153	
110	FDV	BOT1		0153	34	0062	0112	
111	STU	T9		0112	21	0076	0329	
112	RAU	P9		0229	60	0092	0197	
113	FSR	T9		0197	33	0076	0203	
114	STU	P9T9		0203	21	0108	0161	
115	RAU	T9		0161	60	0076	0531	
116	FMP	THREF		0531	39	0484	0534	
117	FAM	P9T9		0534	37	0108	0385	
118	NZU	NEXT	CONT1	0385	44	0239	0140	
119	NEXT	BMI	CONT1	0239	46	0140	0343	
120	CONT2	PCH	S0001	0343	71	0077	0377	
121	PCH	I0001	0000	HALT	0377	71	0127	0000
122	CONT1	RAU	T10		0140	60	0178	0483
123	FMP	S0003			0483	39	0079	0379
124	FMP	3P727			0379	39	0285	0425
125	FDV	I0001			0435	34	0127	0427
126	FAD	T6			0427	32	0074	0301
127	FDV	BOT1			0301	34	0062	0162
128	STU	T6			0162	21	0074	0477
129	FMP	100			0477	39	0098	0298
130	FDV	T9			0298	34	0076	0276
131	STU	S0003			0276	21	0079	0382
132	LDD	G02			0382	60	0485	0188
133	STD	1950	1961		0188	24	1950	1961
134	RAU	H0009		START Q3	0485	60	0009	0213
135	FSR	Z0009			0213	33	0021	0247
136	FMP	A0009			0247	39	0033	0533
137	STU	C9			0533	21	0088	0291
138	RAU	H0010			0291	60	0010	0265
139	FSR	Z0010			0265	33	0022	0199
140	FMP	A0010			0199	39	0034	0584
141	STU	C10			0584	21	0138	0341
142	RAU	C9			0341	60	0088	0393
143	FSR	B0009			0393	33	0045	0221
144	STU	T9			0221	21	0076	0429
145	RAU	C10			0429	60	0138	0443
146	FSR	B0010			0443	33	0046	0223
147	STU	T10			0223	21	0178	0581
148	RAU	T9			0581	60	0076	0621
149	FDV	100			0631	34	0098	0348
150	STU	F4			0348	21	0086	0289
151	RAU	T10			0289	60	0178	0583
152	FDV	I0001			0583	34	0127	0527
153	STU	F6			0527	21	0282	0535
154	FAD	F4			0535	32	0086	0263
155	STU	F4+6			0263	21	0068	0271
156	RAU	F4			0271	60	0086	0391
157	FDV	F4+6			0391	34	0068	0168
158	STU	X4		X 4	0168	21	0122	0125
159	FDV	P780H			0125	34	0284	0634
160	FAD	ONF			0634	32	0481	0107

161	STU	ROT1		0107	21	0062	0315	
162	RAU	T9		0315	60	0076	0681	
163	FMP	10001		0681	39	0127	0577	
164	FMP	P268C		0577	39	0101	0351	
165	FDV	100		0351	34	0098	0398	
166	FAD	T10		0398	32	0178	0105	
167	FDV	ROT1		0105	34	0062	0212	
168	STU	T10		0212	21	0178	0731	
169	FMP	100		0731	39	0098	0448	
170	FDV	P9		0448	34	0092	0142	
171	STU	10001		0142	21	0127	0330	
172	LDD	G03		0330	69	0633	0186	
173	STD	1950	1961	0186	24	1950	1961	
174	G03	RAU	H0009	START Q4	0633	60	0009	0313
175		FSR	Z0009		0313	33	0021	0297
176		FMP	A0009		0297	39	0033	0683
177		STU	C9		0683	21	0088	0441
178		RAU	H0011		0441	60	0011	0365
179		FSR	Z0011		0365	33	0023	0249
180		FMP	A0011		0249	39	0035	0585
181		STU	C11		0585	21	0090	0493
182		RAU	C9		0493	60	0088	0543
183		FSP	B0009		0543	33	0045	0321
184	STU	T9		0321	21	0076	0479	
185	RAU	C11		0479	60	0090	0295	
186	FSR	B0011		0295	33	0047	0273	
187	STU	T11		0273	21	0228	0781	
188	RAU	T9		0781	60	0076	0831	
189	FDV	100		0831	34	0098	0498	
190	STU	F4		0498	21	0086	0339	
191	RAU	T11		0339	60	0228	0733	
192	FDV	10002		0733	34	0128	0278	
193	STU	F7		0378	21	0432	0635	
194	RAU	F4		0635	60	0086	0491	
195	FDV	P780H		0491	34	0284	0684	
196	STU	MIDFN		NFG QT	0684	21	0238	0541
197	RAU	F7			0541	60	0432	0487
198	FSR	MIDFN		POS QT	0487	33	0238	0415
199	STU	DEN			0415	21	0070	0323
200	RAU	F4			0323	60	0086	0591
201	FDV	DEN			0591	34	0070	0120
202	STU	X4		X 4	0120	21	0122	0175
203	RAU	T9			0175	60	0076	0381
204	FMP	10002			0881	39	0128	0428
205	FMP	1196			0429	39	0201	0401
206	FDV	100			0401	34	0098	0548
207	STU	NUM			0548	21	0102	0155
208	RAU	X4			0155	60	0122	0627
209	FDV	P780H			0627	34	0284	0734
210	FAD	ONF			0734	32	0481	0157
211	STU	ROT1			0157	21	0062	046F
212	RAU	T11			0465	60	0228	0783
213	FSR	NUM			0783	33	0102	0529
214	FDV	ROT1			0529	34	0062	0262
215	STU	T11			0262	21	0228	0931
216	FMP	100			0931	39	0098	0598
217	FDV	P9			0598	34	0092	0192
218	STU	10002			0192	21	0128	0981

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219	LDD	G04		0981	69	0784	0537
220	STD	1950	1961	0537	24	1950	1961
221	RAU	H0006		0784	60	0006	0211
222	FSR	Z0006		0211	33	0018	0345
223	FMP	A0006		0345	39	0030	0380
224	STU	C6		0380	21	0184	0587
225	RAU	H0009		0587	60	0009	0363
226	FSR	Z0009		0363	33	0021	0347
227	FMP	A0009		0347	39	0023	0833
228	STU	C9		0833	21	0088	0641
229	RAU	H0010		0641	60	0010	0515
230	FSR	Z0010		0515	33	0022	0299
231	FMP	A0010		0299	39	0034	0834
232	STU	C10		0834	21	0138	0691
233	RAU	C6		0691	60	0184	0389
234	FSR	B0006		0389	23	0042	0169
235	STU	T6		0169	21	0074	0677
236	RAU	C9		0677	60	0088	0593
237	FSR	B0009		0593	33	0045	0371
238	STU	T9		0371	21	0076	0579
239	RAU	C10		0579	60	0138	0643
240	FSR	B0010		0643	33	0046	0373
241	STU	T10		0373	21	0178	0482
242	FMP	100		0482	20	0098	0648
243	FDV	P9		0648	24	0092	0242
244	FDV	I0001		0242	34	0127	0727
245	STU	X6		0727	21	0072	0226
246	FDV	P209E		0225	34	0278	0478
247	FAD	ONF		0478	32	0481	0207
248	STU	B0T1		0207	21	0062	0565
249	RAU	T10		0565	60	0178	0883
250	FMP	S0003		0883	39	0079	0629
251	FMP	3P727		0629	39	0285	0685
252	FDV	I0001		0685	24	0127	0777
253	FAD	T6		0777	32	0074	0451
254	FDV	B0T1		0451	34	0062	0312
255	STU	T6		0312	21	0074	0827
256	RAU	T10		0827	60	0178	0933
257	FMP	100		0933	39	0098	0698
258	FMP	3P727		0698	39	0285	0735
259	FDV	I0001		0735	24	0127	0877
260	FAD	T9		0877	32	0076	0253
261	FDV	B0T1		0253	34	0062	0362
262	STU	T9		0362	21	0076	0679
263	RAU	T6		0679	60	0074	0729
264	FMP	100		0729	39	0098	0748
265	FDV	P9		0748	24	0092	0292
266	STU	S0004		0292	21	0080	0983
267	RAU	T9		0983	60	0076	0532
268	FMP	100		0532	39	0098	0798
269	FDV	P9		0798	24	0092	0342
270	STU	S0007		0342	21	0083	0236
271	LDD	G05		0236	69	0439	0392
272	STD	1950	1961	0392	24	1950	1961
273	RAU	H0009		0439	60	0009	0413
274	FSR	Z0009		0413	33	0021	0397
275	FMP	A0009		0397	39	0033	0884
276	STU	C9		0884	21	0088	0741

277	RAU	H0010	0741	60	0010	0615		
278	FSR	Z0010	0615	33	0022	0349		
279	FMP	A0010	0349	39	0034	0934		
280	STU	C10	0934	21	0138	0791		
281	RAU	H0012	0791	60	0012	0117		
282	FSR	Z0012	0117	33	0024	0501		
283	FMP	A0012	0501	39	0036	0286		
284	STU	C12	0286	21	0190	0693		
285	RAU	C9	0693	60	0088	0743		
286	FSR	B0009	0743	33	0045	0421		
287	STU	T9	0421	21	0076	0779		
288	RAU	C10	0779	60	0138	0793		
289	FSR	B0010	0793	33	0046	0423		
290	STU	T10	0423	21	0178	0582		
291	RAU	C12	0582	60	0190	0395		
292	FSR	B0012	0395	33	0048	0275		
293	STU	T12	0275	21	0430	0984		
294	RAU	T10	0984	60	0178	0785		
295	FMP	I00	0785	39	0098	0849		
296	FDV	P9	0848	34	0092	0442		
297	FDV	I0001	0442	34	0127	0927		
298	STU	X6	X 6		0927	21	0072	0325
299	FDV	P209F	0325	34	0278	0528		
300	FAD	ONF	0528	32	0481	0257		
301	STU	BOT1	0257	21	0062	0665		
302	RAU	T10	0665	60	0178	0835		
303	FMP	I00	0835	39	0098	0898		
304	FMP	3P727	0898	39	0285	0885		
305	FDV	I0001	0885	24	0127	0977		
306	FAD	T9	0977	32	0076	0303		
307	FDV	BOT1	0303	34	0062	0412		
308	STU	T9	0412	21	0076	0829		
309	RAU	T12	0829	60	0430	0935		
310	FDV	BOT1	0935	34	0062	0462		
311	STU	T12	0462	21	0430	0985		
312	RAU	T9	0985	60	0076	0632		
313	FMP	I00	0632	39	0098	0948		
314	FDV	P9	0948	34	0092	0492		
315	STU	S0008	0492	21	0084	0637		
316	RAU	T12	0637	60	0430	0336		
317	FMP	I00	0336	39	0098	0998		
318	FDV	P9	0998	34	0092	0542		
319	STU	I0003	0542	21	0129	0682		
320	LDD	G06	0682	69	0386	0489		
321	STD	1950	0489	24	1950	1961		
322	RAU	H0002	1961		0386	60	0002	0307
323	606	FSR	0307	33	0014	0841		
324	FSR	Z0002	0841	39	0026	0326		
325	FMP	A0002	0326	21	0480	0436		
326	STU	C2	0436	60	0009	0463		
327	RAU	H0009	0463	33	0021	0447		
328	FSR	Z0009	0447	39	0033	0486		
329	FMP	A0009	0486	21	0088	0891		
330	STU	C9	0891	60	0480	0536		
331	RAU	C2	0536	33	0038	0715		
332	FSR	B0002	0715	21	0170	0473		
333	STU	T2	0473	60	0088	0843		
334	RAU	C9	0843	33	0045	0471		
335	FSR	B0009						

START 07

326	STU	T9		0471	21	0076	0879	
337	FDV	P9		0879	34	0092	0592	
338	STU	X4		0592	21	0122	0375	
339	FDV	P780H	X 4	0375	34	0284	0586	
340	FAD	ONE		0586	32	0481	0357	
341	STU	BOT1		0357	21	0062	0765	
342	RAU	T2		0765	60	0170	0425	
343	FDV	BOT1		0425	34	0062	0512	
344	STU	T2		0512	21	0170	0523	
345	FMP	100		0523	39	0098	0399	
346	FDV	P9		0399	34	0092	0642	
347	STU	S0001		0642	21	0077	0530	
348	LDD	G07		0530	69	0636	0530	
349	STD	1950	1961		0530	24	1950	1961
350	RAU	H0004		START Q8	0636	60	0004	0109
351	FSR	Z0004			0109	33	0016	0893
352	FMP	A0004			0893	39	0028	0578
353	STU	C4			0578	21	0732	0686
354	RAU	H0009			0686	60	0009	0513
355	FSR	Z0009			0513	33	0021	0497
356	FMP	A0009			0497	39	0033	0736
357	STU	C9			0736	21	0088	0941
358	RAU	C4			0241	60	0732	0687
359	FSR	B0004			0687	33	0040	0167
360	STU	T4			0167	21	0172	0475
361	RAU	C9			0475	60	0088	0943
362	FSR	B0009			0243	33	0045	0521
363	STU	T9			0521	21	0076	0929
364	FDV	P9			0929	34	0092	0692
365	STU	X4		X 4	0692	21	0122	0525
366	FDV	P780H			0525	34	0284	0786
367	FAD	ONE			0786	32	0481	0407
368	STU	BOT1			0407	21	0062	0815
369	RAU	T4			0815	60	0172	0628
370	FDV	BOT1			0628	34	0062	0562
371	STU	T4			0562	21	0172	0575
372	FMP	100			0575	39	0098	0449
373	FDV	P9			0449	34	0092	0742
374	STU	S0002			0742	21	0078	0782
375	LDD	G08			0782	69	0836	0589
376	STD	1950	1961		0589	24	1950	1961
377	RAU	H0007		START Q9	0836	60	0007	0261
378	FSR	Z0007			0261	33	0019	0445
379	FMP	A0007			0445	39	0031	0832
380	STU	C7			0832	21	0886	0639
381	RAU	H0009			0639	60	0009	0563
382	FSR	Z0009			0563	33	0021	0547
383	FMP	A0009			0547	39	0033	0936
384	STU	C9			0936	21	0088	0991
385	RAU	C7			0991	60	0886	0792
386	FSR	P0007			0792	33	0043	0219
387	STU	T7			0219	21	0124	0678
388	RAU	C9			0678	60	0088	0993
389	FSR	B0009			0993	33	0045	0571
390	STU	T9			0571	21	0076	0979
391	FDV	P9			0979	34	0092	0842
392	STU	X4		X 4	0842	21	0122	0625
393	FDV	P780H			0625	34	0284	0986

394	FAD	ONF		0986	32	0481	0457		
395	STU	ROT1		0457	21	0062	0865		
396	RAU	T7		0865	60	0124	0580		
397	FDV	ROT1		0580	34	0062	0612		
398	STU	T7		0612	21	0124	0728		
399	FMD	100		0728	39	0098	0499		
400	FDV	PR		0499	34	0092	0892		
401	STU	50005		0892	21	0081	0737		
402	RAU	PR		0737	60	0092	0597		
403	STU	10004		0597	21	0130	0787		
404	PCH	10001		0787	71	0127	0778		
405	PCH	50001	HALT	0778	71	0077	0000		
406	ONF	10	0000	0051	0481	10	0000	0051	
407	1196	11	9600	0049	0201	11	9600	0049	
408	100	10	0000	0053	0098	10	0000	0053	
409	P7804	-	78	0800	0050	0284	-	0800	0050
410	P268C	-	26	8300	0050	0101	-	8300	0050
411	3P727	-	37	2700	0051	0285	-	2700	0051
412	P209F	-	20	9500	0050	0278	-	9500	0050
413	THREF	-	30	0000	0049	0484	-	0000	0049
414	MIN1	-	10	0000	0051	0187	-	0000	0051
415	HALT	01	9999	9999	0000	01	9999	9999	

IBA: 650 IPER CAR LUAD

6919531952+	2419611954+	7019621950+	6919561955+	2419628000+	60195
6919531952+	2419631954+	3000011964+	6919561955+	2419648000+	80800
6919531952+	2419651954+	580021966+	6919561955+	2419668000+	35000
6919531952+	2419671954+	8280031968+	6919561955+	2419688000+	88000
6919531952+	2419691954+	6979501970+	6919561955+	2419708000+	24200
6919531952+	2419711954+	5300011972+	6919561955+	2419728000+	42197
6919531952+	2419731954+	5000011974+	6919561955+	2419741961+	58000
7000000017+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	55000000052+	36000000052+	16000000052+	17000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	13000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000051+	10000000051+	10000000051+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	54300000052+	40000000052+	82300000052+	22000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	11000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000053+	10000000053+	30000000051+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	66500000052+	58000000052+	17000000052+	17000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	13000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000053+	10000000051+	10000000051+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	82000000052+	53000000052+	18000000052+	17000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	13000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000051+	30000000053+	10000000051+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	82000000052+	46000000052+	78700000052+	17000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	10000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000051+	10000000051+	30000000053+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	64800000052+	44000000052+	16000000052+	17000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	13000000052+	11000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	30000000053+	10000000051+	10000000051+	10000
17+	10000000052+	15000000052+	40000000051+	70000000051+	10000
85+	10000000052+	24100000052+	48000000052+	16200000052+	74000
137+	10000000052+	10000000052+	40000000051+	60000000051+	10000
205+	10000000052+	10000000052+	10000000052+	13000000052+	10000
257+	10000000051+	10000000051+	10000000051+	10000000051+	10000
325+	10000000051+	10000000053+	10000000051+	10000000051+	20000
17+	10000000052+	76000000052+	40000000051+	70000000051+	10000
85+	10000000052+	15000000052+	40000000051+	16000000052+	10000

## IBA: 650 71251 C10 LOAD

4+	7019621950+	6919561955+	2419628000+	6019511962+	1
4+	3000011964+	6919561955+	2419648000+	8080031965+	2
4+	5580021966+	6919561955+	2419668000+	3500011967+	3
4+	8280031968+	6919561955+	2419688000+	8800021969+	4
4+	6979501970+	6919561955+	2419708000+	2420001971+	5
4+	5300011972+	6919561955+	2419728000+	4219731961+	6
4+	5000011974+	6919561955+	2419741961+	5800011969+	7
2+	15000000052+	40000000051+	70000000051+	10000000052+	18000000052+
2+	55000000052+	26000000052+	16000000052+	17000000052+	CALIB Q 0
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	13000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000051+	10000000051+	10000000051+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	42000000052+
2+	54300000052+	40000000052+	82300000052+	22000000052+	CALIB Q 1
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	11000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000053+	10000000053+	30000000051+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	51000000052+
2+	66500000052+	58000000052+	17000000052+	17000000052+	CALIB Q 2
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	13000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000053+	10000000051+	10000000051+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	26000000052+
2+	82000000052+	53000000052+	18000000052+	17000000052+	CALIB Q 3
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	13000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000051+	30000000053+	10000000051+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	26000000052+
2+	82000000052+	46000000052+	78700000052+	17000000052+	CALIB Q 4
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	10000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000051+	10000000051+	30000000053+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	66700000052+
2+	64800000052+	44000000052+	16000000052+	17000000052+	CALIB Q 5
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	13000000052+	11000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000053+	10000000051+	10000000051+	10000000051+	
2+	15000000052+	40000000051+	70000000051+	10000000052+	20000000052+
2+	24100000052+	48000000052+	16000000052+	74000000052+	CALIB Q 6
2+	10000000052+	40000000051+	60000000051+	10000000052+	10000000052+
2+	10000000052+	10000000052+	13000000052+	10000000052+	
1+	10000000051+	10000000051+	10000000051+	10000000051+	30000000051+
1+	30000000053+	10000000051+	10000000051+	20000000052+	
2+	76000000052+	40000000051+	70000000051+	10000000052+	26000000052+
2+	15000000052+	40000000051+	15000000052+	10000000052+	CALIB Q 7

